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Controlling Production Costs in the Small Shop

By E. A. Terrell

The Terrell Machine Company, Inc.

Someone has said there is no secret about having a successful business. All that is necessary is to sell goods for more than they cost. But can the small shop know its costs accurately without a cumbersome and expensive record-keeping system?

IF THE head of a small- or medium-sized plant attempts to keep costs and to control production with a system as elaborate as is required by the large plant, he finds that either his office force is loaded with detail, or his overhead goes skyward. On the other hand, if he does not keep his costs accurately, and if he has no production control, he is quite likely to receive some first-hand instruction in the bankruptcy laws. Too much or too little system are both disastrous.

Accountants are usually well trained in their profession, but it is a fallacy to assume that they are so well versed in manufacturing as to be able to outline a plan of control for each plant with which they come into contact. One must live with a business to know all the possible variations to which it is subjected, and certainly one who is acquainted with such details is better fitted to control them than is another who has a mere casual acquaintance with them. It is hardly open to argument that the manager of a small plant is the man who should accept the task. He will probably require expert aid from his accountant when the time arrives for putting the details together, but it is for him to decide the kind of information required, and the general method of collecting it.

Several years ago the writer, in company with others, started a small business. The work consisted in making special machines of their own design. It was their first venture in manufacturing and, looking backward, they can now see that in the beginning they did everything wrong. Nevertheless, because of good business conditions, they prospered, and gradually they realized the need for accurate costs. They called in their accountants, but the system they advised was so complicated and required the addition of so many office and shop assistants, that the company heads decided to study their own needs and to devise a system that would meet these needs.

A detailed story of their failures would serve only as advice as to what to avoid, and this article deals with constructive suggestions rather than with warnings. However, one failure is worthy of mention because it was the underlying cause of their present method of handling indirect or overhead costs. They tried to distribute their overhead over each job. The results were anything but satisfactory. In addition to involving them in a mass of figures, they found that their shop costs were so well concealed in the result that they could not tell whether variations were due to labor and material costs or to overhead. Distribution may be all right for the plant that can afford plenty of clerical workers, but it did not work in this case. They have now found out how to provide for the inclusion of indirect costs in selling prices by a much more direct method.

The success of any system depends upon how it is operated. While this statement is a platitude, it is nevertheless true. The personnel is, therefore, of first importance. In any cost- and production-control system there are three items that must be controlled. They are labor, material, and indirect costs. While these items may travel along quite a devious pathway in different stages of production, passing from hand to hand, it may be stated in general that the shop foreman can keep track of

The first part of the article. The second part will appear in an early issue.

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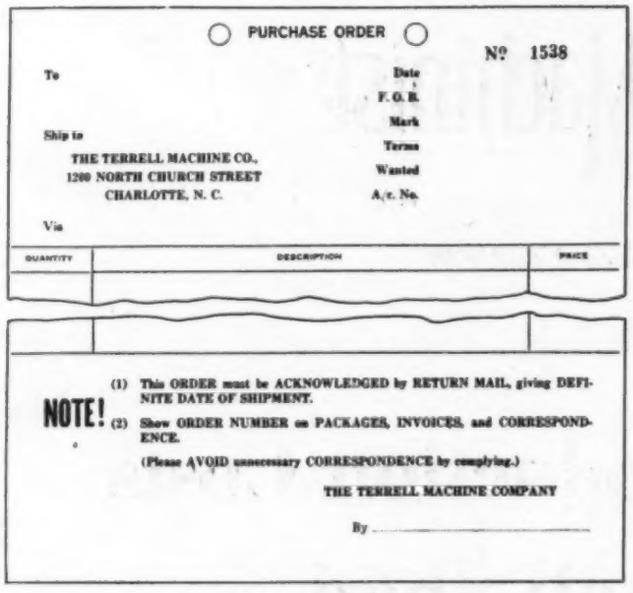


PURCHASE ORDER

Nº 1538

To

Date
F. O. B.
Mark
Terms
Wanted
A/c. No.

Ship to
THE TERRELL MACHINE CO.,
1200 NORTH CHURCH STREET
CHARLOTTE, N. C.

Via

QUANTITY	DESCRIPTION	PRICE

NOTE! (1) This ORDER must be ACKNOWLEDGED by RETURN MAIL, giving DEFINITE DATE OF SHIPMENT.
(2) Show ORDER NUMBER on PACKAGES, INVOICES, and CORRESPONDENCE.
(Please AVOID unnecessary CORRESPONDENCE by complying.)

THE TERRELL MACHINE COMPANY

By .....

Fig. 1—Original purchase order

the labor, the stockkeeper can control the materials, the bookkeeper can provide an accurate record of indirect costs, and the cost clerk can care for the assembly of cost data on work orders. To the small shop this presents an imposing array of clerical workers. However, it is not as serious as it looks at first glance. The stenographer handles all cost work, issues all work orders and takes care of the correspondence. The stockkeeper is also charged with the duties of receiving clerk, shipping clerk, inspector and tool clerk. He more than pays his way by savings in materials and tools, in addition to providing us with an accurate, perpetual inventory of the stock on hand. The foreman schedules the work in the shop, supervises the workmen, and sees that accurate time records are kept on all the jobs. The bookkeeper summarizes the cost data from incoming invoices and from information received from the stenographer. When the volume of output is small, the stenographer may also do the bookkeeping.

While it is possible to adopt this system part by part, experience has shown the wisdom of working out and testing the plan as a whole. The difference is the same as that between a completed house and one piece of lumber. One looks like a house, while the other has little resemblance to the finished structure. This article will be better understood, however, if each section is considered separately.

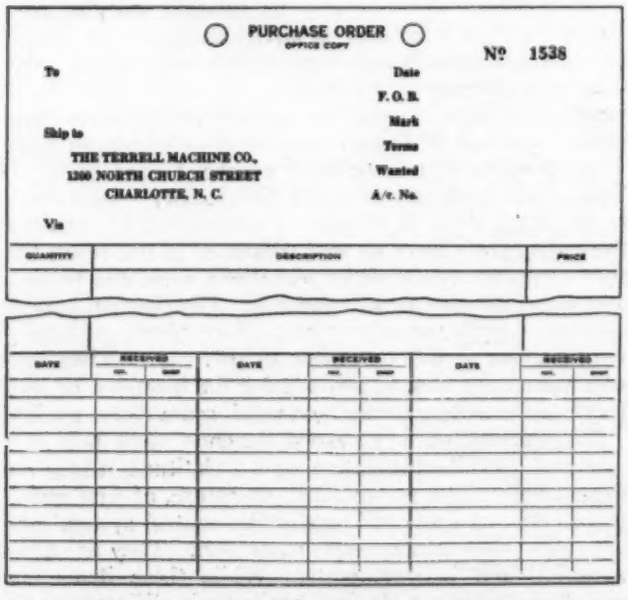
Before a product can be sold, it must be made. This involves the purchase of materials, either finished, semi-finished, or raw. Beginning, therefore, with the purchase order, this order should provide three things:

1. Instructions to the supplying firm as to what is wanted, when it is wanted, and where.
2. Information to all concerned covering the same points.
3. Provision for recording receipts, for checking them against charges, and for the designation of the account to which the material is to be charged.

Purchase orders are made in triplicate. The original, Fig. 1, is mailed to the supplying firm. The duplicate, Fig. 2, is filed in the office, and the triplicate, Fig. 3, is sent to the stockroom. When delivery of the material has been made, receipts are noted on the shop copy, and when completed, the stockkeeper turns in the order to the bookkeeper. The bookkeeper compares the quantities received with the quantities invoiced, traces any variations, and enters the charges in the proper accounts.

Sometimes, if materials are urgently needed, verbal orders are placed for them. The receipt of such materials is noted on the daily report form, Fig. 4, in which space is provided for all items rejected and returned. This form is filled out only when special items, not covered by regular purchase orders, are received. All special receipts for the entire day are entered on one sheet.

The stenographer issues purchase orders on requisition from the foreman or the stockkeeper. The originals are passed to the manager for his signature, and the requisition is returned to the shop with the shop copy of the order, indicating that the material has been purchased. The requisition form is shown in Fig. 5. It provides space for both the purchase-order number and the work-order number, depending upon whether the material is to



PURCHASE ORDER
OFFICE COPY

Nº 1538

To

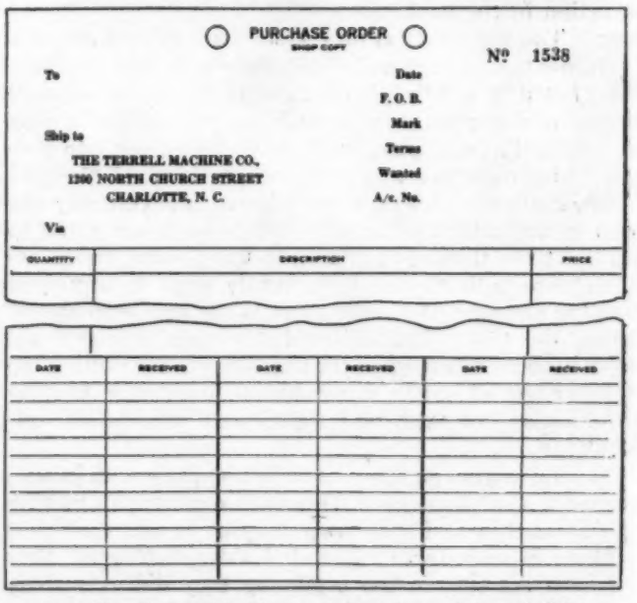
Date
F. O. B.
Mark
Terms
Wanted
A/c. No.

Ship to
THE TERRELL MACHINE CO.,
1200 NORTH CHURCH STREET
CHARLOTTE, N. C.

Via

QUANTITY	DESCRIPTION	PRICE

DATE	RECEIVED		DATE	RECEIVED		DATE	RECEIVED	



PURCHASE ORDER
SHOP COPY

Nº 1538

To

Date
F. O. B.
Mark
Terms
Wanted
A/c. No.

Ship to
THE TERRELL MACHINE CO.,
1200 NORTH CHURCH STREET
CHARLOTTE, N. C.

Via

QUANTITY	DESCRIPTION	PRICE

DATE	RECEIVED	DATE	RECEIVED	DATE	RECEIVED

Figs. 2 and 3—Duplicate and triplicate purchase orders. They are readily distinguishable by their colors, pink and light green, respectively. The original purchase order is white

be obtained by purchase or by manufacture. In either case, the requisition is returned to the stockkeeper with the copy of the proper order. When a requisition is received by the stenographer, calling for items by manufacture and stating that there is no raw material on hand, she prepares a purchase order for the material and a work order for the conversion of that material into finished stock. The time for issuing requisitions depends upon the available supply of the materials wanted, and will be discussed later.

Having materials available, the next step is to convert them into finished product. This requires the issuance of work orders, which are made in triplicate. The office copy, Fig. 6, is printed on both sides. The front provides space for the usual instructions and additional spaces for calculating the materials used, and for a cost summary. The back provides for the listing of labor, as posted from the daily time cards.

The shop copy, Fig. 7, is printed on one side only. In the lower left-hand quarter, spaces are provided for entering the employee's number whenever work on the order is assigned to him. The blank space in the lower right-hand corner is left for remarks by the foreman covering any special event occurring in the progress of the order. The stock copy, Fig. 8, is also printed on one side only. In the lower left-hand corner is provided a space for recording materials issued to the workmen. On the right, just below the instructions, is a space for checking-in the finished product when it is returned to the stockroom. Just below is a form for reporting any defective workmanship, indicating the reason for the defect and stating whether the item can be repaired or will have to be scrapped. This particular form was originated by someone other than the writer, and for its purpose nothing can be simpler. The entire story is told by marking the number of defective items in the repair or scrap columns, opposite the proper cause in the center. Thus, it will be noted that the stock copy contains a complete record of the materials from the time they are issued until they are again in the stockroom.

STOCK SHORTAGE

PART NO. OR SIZE	MATERIAL	MINIMUM	ORDER	SHOP ORDER	PURCHASE ORDER
D-9	C9	15	30	1650	

IS MATERIAL IN STOCK? yes

REMARKS:

DATE 5-3-1929 BY: EC.

Fig. 5—Requisition from the foreman or the stockkeeper for material to be purchased, material already in stock, or for material to be manufactured

The workman must be provided with full instructions if he is to avoid errors and delays. A study of jobs in the average manufacturing plant will show that they are divided into the following two general classes:

1. The making of parts that consist of one piece, on which one or more operations are to be performed.

2. The making of assemblies comprising more than one part, and so designed that the parts may be machined more cheaply and easily when certain operations are performed on two or more parts at the same time.

For class 1, a 5x8-in. card will usually provide ample space for all necessary instructions. In Fig. 9, such a card is shown. For class 2, an 8½x11-in. sheet, such as is shown in Fig. 10, is more satisfactory because of the increased space for entering data. However, it will be noted that these forms are really the same, except that

(DAILY REPORT) RECEIPTS DATE

FROM	QUANTITY	DESCRIPTION	RUSH	P/S

RETURNED

TO	QUANTITY	DESCRIPTION	REASON

Fig. 4—Form for daily report of receipts of material ordered verbally because of urgent need

the sheet allows more space. On the card, it will be observed that the column headings, Opn. No.; Machine; and Instructions are printed, while on the sheet they are filled in on the typewriter, and that an additional column is provided for Screws, etc. This is because the sheet form has been found useful for a third purpose. On practically all machines there are interchangeable assemblies, made for the same general purpose but comprising different parts.

An example is in the method of driving the machine. One purchaser wants a belt-driven machine, while another prefers one with a motor drive. On one sheet are listed all the parts required for the driving mechanism

(OFFICE COPY) WORK ORDER No. Issued 5/3/29 Finished 5-7-29 Charge Eqp. A/c.

Quantity Wanted	ITEM	INSTRUCTIONS
30	D-9	Per Instruction Card.

MATERIAL USED

Kind	Quant	Price	Amount
C.2 1.5#	45#	cwt	3 98
30			
450			
Total			

COST SUMMARY

	Finished	Labor	Material	Total	✓
OK	30	6 16	3 98	10 14	
RO					
Per Unit		.33	.13	.55	

(LABOR) WORK ORDER No.

Date	No.	Amount	Date	No.	Amount	Date	No.	Amount
5-5-29	4	3 15	Forwarded			Forwarded		
5-7-29	6	3 71						
		.6 16						
Total			Total			Total		

Fig. 6—Front and back of the office copy of the work order. The front has spaces for the usual instructions and for the cost summary. The back is devoted to labor, as posted from the time cards

(SHOP COPY) **WORK ORDER No.**

Issued 8/3/29
Finished 8-7-29
Charge Mfg. A/c.

Quantity Wanted	ITEM	INSTRUCTIONS
30	D-9	Per Instruction Card

→ GOOD ONLY FOR OPERATIONS INDICATED ←

EMPLOYEE NUMBER

4
6

Fig. 7

(STOCK COPY) **WORK ORDER No.**

Issued 5/3/29.
Finished
Charge Mfg. A/c.

Quantity Wanted	ITEM	INSTRUCTIONS
30	D-9	Per Instruction Card.

If MATERIAL is not in stock, NOTIFY OFFICE AT ONCE.

Quantity	MATERIAL ISSUED	Raw	Fin
30	Castings D-9	✓	

Quantity	RETURNED TO STOCK	
30	D-9	all OK

REPAIR	DEFECTIVE	SCRAP
	Workmanship	
	Material	
	Instruction	
	Equipment	

Fig. 8

Figs. 7 and 8—Shop and stock copies of the work order. They are printed on one side only. The blank space in the lower right-hand corner of the shop copy is for remarks by the foreman covering anything special regarding the progress of the order

of a belt-driven machine, and on another sheet the parts for a machine with motor drive. These parts are finished on separate work orders and are taken from finished stock. Consequently, no work order is issued covering the assembly. The sheet is used for record and cost purposes only, and is not used for the purpose of instructing the workman. It does serve as a guide for the stockkeeper, however, so that he knows just what finished parts to issue for an assembly, and in the office it gives the cost department the same necessary information. Also, it is used with a code system for recording the equipment furnished with each machine. This code system was described in an article on page 843, Vol. 70, of the *American Machinist*.

D-9 | Cam Trip Stand

D	1	30	15	30	9	14	20-20

Cast Iron 1 1/2 #

1	402	Mill base; slot base; slot for roller.
2	101	Drill all holes, using Jig # D-9. Tap one hole 5/16" U.S.S.

Fig. 9—Instruction card. On this card all instructions for completing the order called for are given, including the machine and the special tools to be used

In the case of this use of the form, the headings are as follows: Per Mch.; Part No.; Part Name; Screws; and similar items. One of these forms properly filled in for the parts required on a belt-drive brake assembly is shown in Fig. 11. A note is added for the information of the stockkeeper and the cost clerk with reference to certain parts to be shipped with the assembly, where it is to be added to a machine not originally equipped with that assembly.

On both the card and the sheet, spaces are provided for Maximum, Minimum and Order. The information under these headings refers to stock available and the quantity to be ordered on a work order or a purchase order. If the material is to be ordered on a purchase order, the instructions consist of the name and address of the supplying firm, together with any needed data to be furnished them. The desired maximum and minimum quantities for each part or assembly are determined by the probable demand and by the time required for replacement. It is well to carry a maximum of three months' supply on all units that can be normally procured within four weeks. The minimum is set at six weeks' supply, giving a leeway of two weeks to allow for any unforeseen delays. In other words, each order for replacement is expected to be completed within four weeks from the date of issue. Some variations are, of course, necessary.

The stockkeeper maintains a perpetual inventory of raw and finished stock, using a visible-card index. Stock forms are used and the maximum and minimum quantities are given, so that he will know when to issue requisitions. The instruction cards are filed in an ordinary drawer file and are indexed with tenth-cut cards by part number. The instruction sheets are filed in a letter file, with the same method of indexing.

Work orders are issued and routed as follows:

1. Upon receipt of a requisition calling for the issuance of a work order, the stenographer takes the proper instruction card or sheet from her file, notes the quantity to be ordered, and makes out the order. The date and the account number, the quantity wanted and the part or assembly number are entered. In the space for instructions she makes the notation, "Per Instruction Card."

D-131-X | Quill Guard Assembly

D	1-S: 2-D	20	10	30	9	21	20-35

Opn. No.	Machine	Operation	Screws
1	100	Drill 2 D-131, Quill Guard Brackets	
2	601 and 100	Cut off, bend, and drill 1-D-136, Quill Guard	
3	Bench	Assemble: Rivet 2 D-131 to 1 D-136	4 RH Iron Rivets, 3/16 x 5/8

Fig. 10—Instruction sheet. This form is used when more than one part is to be made on the same order. It has space for more items than the instruction card

	P-151-X	Brake Assembly (Belt Drive only)						
	F	1						none

This is not a manufacturing assembly, but is used for cost and record purposes only.

Per Mch.	Part No.	Part Name	Screws
1	P-151	Brake, with 1 P-152 Brake Lining attached	1 Sq Hd Set Screw, 5/16" x 5/8" 3 Copper Brake Band Rivets #10 x 1/2"
1	P-153	Brake Roller	
1	P-154	Brake Roller Pin	2 Cotter Pins, 1/16" x 3/4"
1	P-155	Brake Spring	
1	P-156	Brake Bracket	2 RH Cap Screws, 5/16" x 3/4" 2 Cut Washers, 1/4"
1	P-159	Brake Pin	1 Cotter Pin, 3/32" x 3/4" 1 Cut Washer, 3/8" Reamed 17/32
1	P-160	Brake Lever	1 Sq Hd Set Screw, 1/4" x 5/8"
1	P-161	Brake Lever Bracket	2 HH Cap Screws, 5/16 x 5/8"
1	P-162	Brake Lever Pin	
1	P-163	Brake Rod	1 Cotter Pin, 1/16" x 3/4" 4 Hex Nuts, 5/16"
		NOTE: For cost purposes, on new machines, the above constitutes the entire assembly. On orders for this assembly, to be applied to old machines, add:	
1	P-[illegible]	Safety Stop Lever Stud	1 SAE Castellated Nut, 5/16" 1 Cotter Pin, 1/16" x 3/4"
1	P-164	Cover Lid Brace	1 FH Iron Rivet, 3/16" x 5/8"

Fig. 11—The form for the instruction sheet is also used for cost and record purposes for the mechanisms employed in different methods of driving machines of the same class

2. The office copy is placed in a post binder labeled, "Incomplete Work Orders."

3. The shop copy, stock copy, instruction card, or sheet, and the requisition are placed in a celluloid shop-traveler, and are sent to the stockkeeper.

4. The stockkeeper immediately checks the material required, unless his requisition shows that he has already done so. He removes the requisition and gives the traveler with its contents to the foreman, at the same time notifying him of the state of the material.

5. The foreman removes the shop copy from the traveler and places it in his file of Incomplete Work Orders. As soon as he is ready to assign the job to a workman, he enters the workman's number in one of the Employee Number spaces on the shop copy, and places the traveler, with the instruction card and the shop copy, in the proper compartment of the "Work Scheduled" rack. This rack may consist of a hook for each workman, or of a box having a shelf for each man. The orders are placed according to the desired schedule, the next in order being on top, and so on.

6. The workman, having punched out on his last job, goes to the rack and gets the next traveler. He takes it to the stockroom and gets the necessary material, which the stockkeeper enters on the Material Issued form, together with any jigs or special tools called for under the operation. The workman then completes his operation as described on the instruction card, using the machine tool specified in the Machine column.

7. (a) If his operation completes the order, the workman turns in the traveler to the stockroom with the finished product. The stockkeeper enters the quantity returned, checks it with the material issued and accounts for any defective parts. When particularly close inspection is wanted, a star is stamped on the front of the instruction card, indicating that the stockkeeper will find remarks about inspection on the back of the card.

7. (b) If his operation does not complete the order, the workman punches out on the job and hangs the traveler on a hook, from which it is later collected by the foreman. The foreman then re-assigns the next operation, as described in paragraph 5. This procedure is repeated until the order is completed.

8. After the completed order has been turned over to the stockkeeper, as described in paragraph 7 (a), and he has made his entries upon the traveler, he gives it to the foreman. The foreman fills in the date finished on the shop copy, and returns the traveler, together with the shop and stock copies and the instruction card, or sheet, to the stenographer.

9. The stenographer transfers the material data from the stock to the office copy, and checks the number of times an employee's number appears on the shop copy with the number of time-card entries in the labor space on the back of the office copy. The shop and stock copies may now be destroyed. The total labor and materials are computed on the office copy and the unit cost is worked out. The unit cost is entered on the part-record sheet, to be described later, which is then filed in the same file with the instruction card. The card is filed in front of the orders, so that it will be quickly available at all times.

A Wage Bonus System That Failed

Discussion

By W. N. Brand
Barr-Morse Corporation

IN HIS narration of the operation of "A Wage Bonus System that Failed," on page 21, Vol. 71, of the *American Machinist*, P. H. Bryant points out the shortcomings he observed in the plan in this particular shop, where at the time he was doing special work. But how can the failure of the wage bonus be laid to anything but poor supervision and a misunderstanding of the principles of modern wage payment and fair treatment of workmen?

Whoever was in charge of that shop evidently did not understand the basic principles of wage payment. The fact that the antiquated system of cutting the allotted time on tasks was practised by the management is, in itself, reason enough for the failure of any plan, and is in no way a reflection on bonus wage payment. Therefore, in general, the article is really an indictment of the inefficiency of the management in the shop under consideration. In fact, the management is to blame in almost every case where an incentive system fails.

There are, of course, shortcomings in any form of bonus payment. Pace-making by means of conveyors, and the application of a regular day-wage payment system in connection with this form of control of output, have advantages under very high production. But there are many industries in which the production is of such small volume, and the work of such varied character, that the pace-making plan is impractical because of the difficulty and expense of instituting and operating the system. Under such conditions, a bonus plan, if correctly administered, will accomplish the desired results of increasing output and satisfying the workmen.

Specialized Production Lathe Fixtures

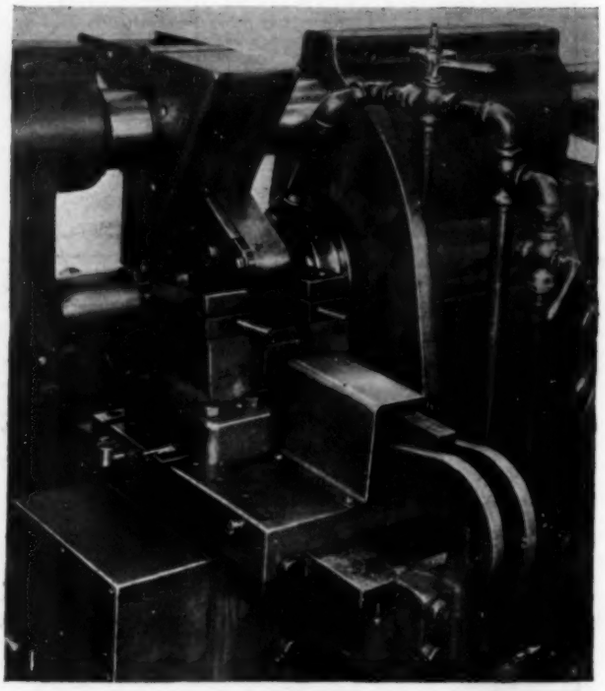


Fig. 1—Set-up for turning caterpillar-track link bushings equipped with a magazine feed. The part is mounted on a driver made with a number of hardened pins. At the end of the cut, the operator stops the machine and removes a finished part. When the carriages are returned to a neutral position, the fixture automatically discharges the rough part which drops down on two blocks resembling a V-block. The air-operated tailstock picks up the part and clamps it against the driver. The work is 3½-in. in length and turns at 490 rev. per minute.

Photographs by courtesy of the Sundstrand Machine Tool Company

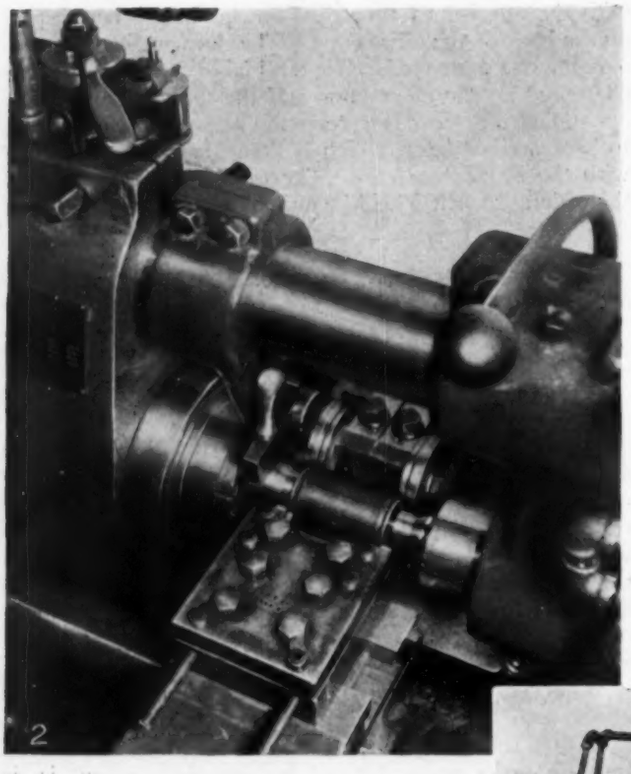


Fig. 2—Machining wheel cylinders for hydraulically controlled 4-wheel brakes. Roughing is done by two sets of tools in the front slide of the machine and finishing by form cutters on the rear slide. The work is held on an air-operated expanding mandrel and is located by the gage block *A* mounted on the overarm. An air-operated tailstock simplifies loading. The work is of cast iron, the depth of cut is ¼ in., the speed 150 r.p.m., and the feed 0.007 per revolution

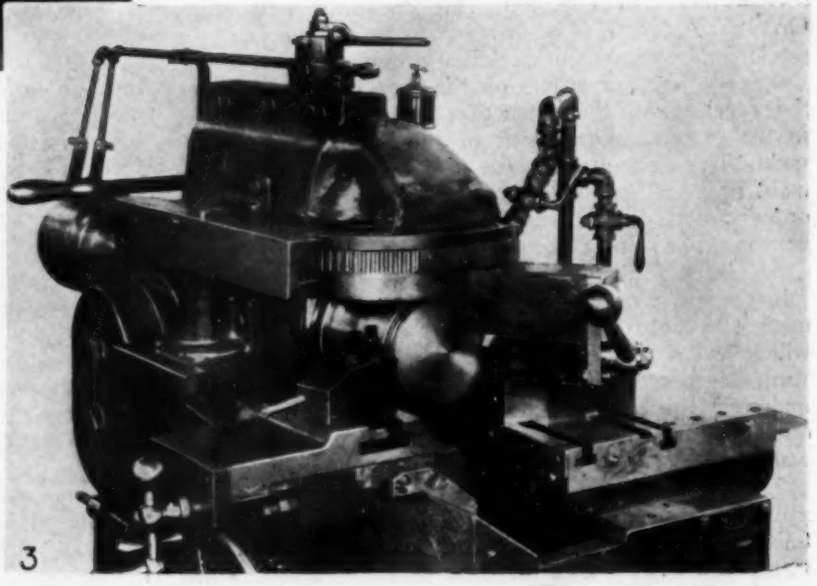
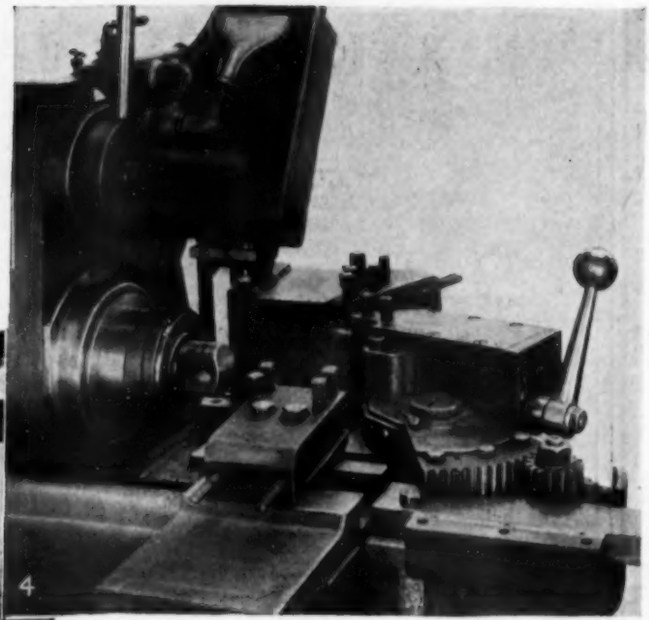


Fig. 3—Turning, crowning, and grooving an aluminum-alloy piston, 3⅛ in. in length, at 230 r.p.m., 0.015 in. feed per rev., with an average depth of cut of $\frac{3}{32}$ in. The work is located on a collar and is drawn back by an air-operated draw bar and a pin located through the wristpin hole. The convex-head piston is machined by an attachment made in the form of a rotating head driven by spur gearing. Provision is made to move the facing cutter away from the work so that it will not mark the work on the return stroke. The front toolblock carries the turning tool and the rear toolblock has a magazine with grooving tools

Fig. 4—Set-up for machining a concave-head piston. The facing device operates automatically by means of a sector and pinion interconnected by spur gearing. When the cut has been completed, the cutter is removed from the face, thus preventing scratching of the finished piece. The gearing is exposed for illustrative purposes only



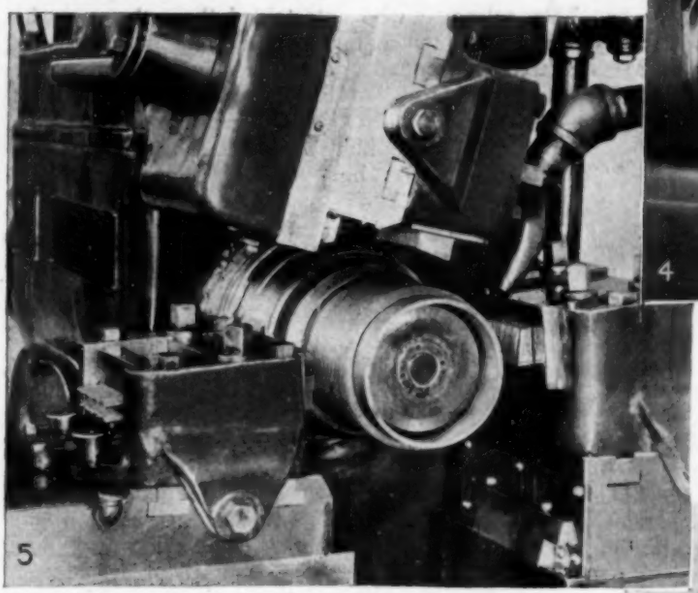
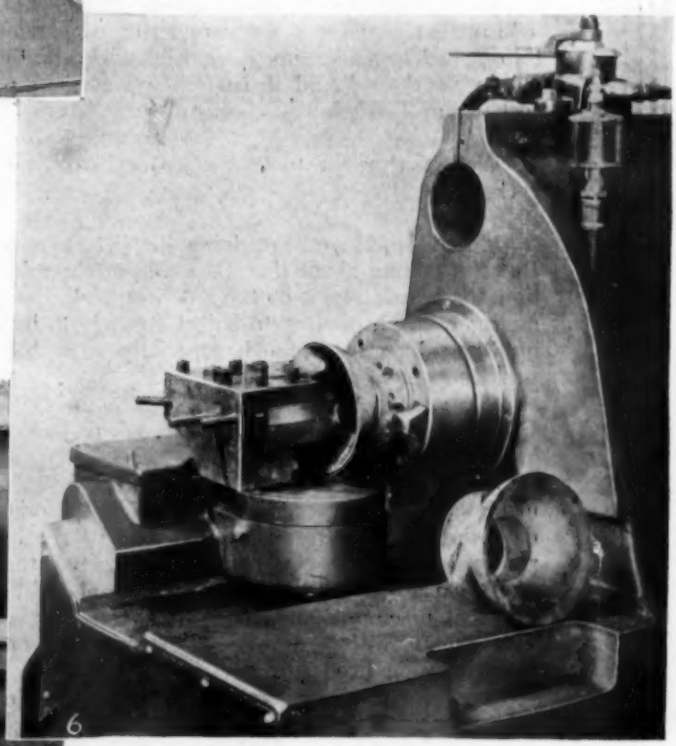


Fig. 5—Turning an aeronautical-type steel cylinder in an automatic lathe equipped with an air-operated expanding chuck. The rear toolslide feeds in toward the center. The front toolblock faces one side of the fins; the overhead attachment faces the other side. Work is machined at 39 r.p.m., 0.008 in. feed per revolution

Fig. 6—Rough-turning a ball and socket joint in a machine equipped with a pivoted, radially-operated toolblock. The operation includes machining both spherical surfaces and double chamfering the open end of the part. An air-operated chuck holds the work which is centered on the outside diameter by a recess in the chuck. The toolblock has one cutter for turning the outside surface, one for turning the inside diameter, and two for chamfering. Roughing is at 80 r.p.m. with a feed of 0.015 in. per rev., and finishing is at 118 r.p.m. with a feed of 0.007 inch



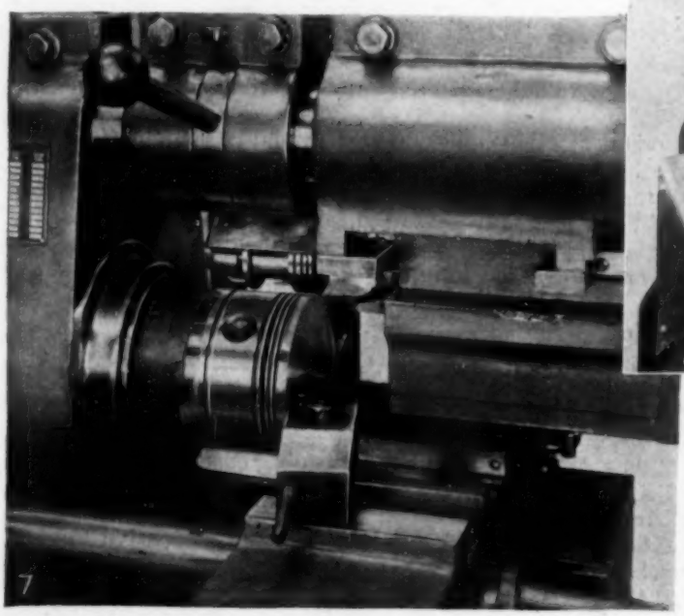


Fig. 7—Finish turning, facing, and grooving airplane-type aluminum-alloy pistons. The manually operated burnishing attachment mounted on the overarm is engaged after the turning and facing cuts have been completed, utilizing a rolling action on the sides of the grooves to finish them to close dimensions. Work is done at 420 r.p.m., and a feed of 0.009 in. per rev. The length of the piston is 3¾ in., and the depth of cut is approximately $\frac{3}{32}$ inch

EXECUTIVE · FORUM

Entertaining—and How Much?

"THIS question of entertaining customers and possible customers is getting to be quite a problem, Bill." It was Jack Hodges of the Fan Company speaking to Mr. Holland, consulting engineer, at a lunch table of the Business Club.

"Do you mean in quality or quantity, Jack?" asked Holland.

"Both, Bill, but particularly quantity. Every time Charlie Knox, our sales manager, is out after some big order that's hard to pull across, he wants to get a large room in the hotel, where he can do some entertaining, and to arrange a few theater parties, and probably a dinner or so, with one or two things on the side he forgets to mention. It runs into a lot of money, Bill, and I'm wondering if it's worth it."

"Lots of managers are wondering the same thing, Jack," spoke up Lew Chadwick of the Pump Works. "And it isn't all on account of cost, either."

"Well, that seems to be the major item," said Jack.

"It may be, if you are doing the entertaining. But I'm talking about the other side of the question, the fellow who is on the receiving end. Some managers are beginning to object strongly to having their men entertained, especially if it happens too often."

"Every hear that angle, Bill?" asked Jack.

"Yes, and plenty, Jack. I was just going to mention it. I ran across an old friend the other day who sent two of his men to one of the big shows last year. He naturally expected they would soak up a lot of information about the different machines, and come back full of good ideas about fitting the new developments into his expansion program.

"However, the men ran into an entertaining salesman on the morning they arrived. He talked his wares to them, and then took them out, and filled them up on bootleg stuff. What they had previously seen of the show faded away, and they had to leave town the next day, so that they didn't carry back much information.

"The boss questioned them when they got back to the plant, and mighty soon found out how little they had learned. He 'smoked' the whole story out of them, and was so ripping mad at the salesman who entertained them that now he wouldn't buy so much as a sheet of sandpaper from his company. Of course he was sore at his own men, too, but he blamed the salesman and his company most of all, because indirectly they not only made him waste the cost of the trip but also made him miss the information he counted on."

"Must have been weak-kneed men to let a highball or two keep 'em from seeing the show," said Jack.

"Maybe so, Jack. But they'd have gone home with some good ideas about the machines if they hadn't been entertained."

"We send out our men to shows to learn something, not to be entertained," said Lew Chadwick. "We feel just as Bill said. The man who tries to entertain our men is on the way to lose our business. We don't want them bribed, and we don't want them interfered with. They are on business at the show, or wherever we send them, and we expect results."

"Some firms," spoke up Holland, "expect their men to make reports of the exhibitions and meetings they attend. It makes them careful to study the machines in their line, and they get a whole lot more out of the trip than if they didn't have to jot down the important facts."

"We haven't gone that far, yet," responded Chadwick, "but we have clamped the lid pretty tight on both entertaining and being entertained."

"My sales manager would raise an awful 'howl' if I shut down on all entertaining," said Hodges. "He wouldn't agree to the idea at all. We've always entertained, and he believes it brings in orders. I don't want to turn business away, but you bet I'm going to think the matter over pretty carefully before I O.K. any more big entertainment funds."

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

DISCUSSION

Interesting Men in the Job

Men cannot be expected to become very enthusiastic about a business regarding which they know nothing. Various methods are employed to give workmen pertinent facts about the company they are working for, thereby stimulating their interest in their jobs. Under representation plans, sometimes these facts are presented by company officers at joint conferences. Some companies prepare graphic charts of their business, for exhibition to the workers or their representatives. In still other companies, occasional lectures are given to employees on various aspects of the business.

An outstanding example of the last-named method is offered by a large electric company. By means of illustrated lectures, in which charts, diagrams, and tables are thrown on the screen and explained, the organization and development of the company are described. Responsibilities of the management are pictured and outlined. Complete annual reports, arranged and expressed in terms that workmen understand, and telling just how the company earns and spends its money, are put before the workers. General facts about the company policy, and finance, are clearly explained to keep the employees informed about the inner affairs of the organization.

—HARRY KAUFMAN, *Public Accountant.*

What Should We Teach Apprentices?

Obviously, the subject matter taught an apprentice working in an engine-building plant should be different from that taught one working in a railway-car-building shop. Our practice has been to teach them the essentials mentioned in the presentation of the topic, plus some machine-tool knowledge, such as regards feeds and speeds, proper tooling, wheel selection for grinding, inaccuracy in machine-tool work and its causes, as well as some definite information relative to the product of the plant that employs the apprentice. Safety, waste, and fire prevention are not to be overlooked.

While special shop instructors are desirable, there are more shops that cannot afford this expense than there are that can, because of their size. In such cases the foreman, or his assistant, can do a good piece of work for one of the qualifications of a good foreman is that he be a teacher. —S. M. BRAH, *Apprentice Supervisor, Tri-City Manufacturers' Association.*

Reducing the Scrap Heap

In plants where adequate inspection systems are in operation, rigid regulations are required regarding the acceptance of parts. However, from 80 to 90 per cent of the rejected parts can usually be used if the effort is made. A good salvage department, with an engineer at the head of it who has ability and common sense, can save considerable money for a company. Repair parts are always needed for every kind of machinery, and in many cases these parts cannot be furnished to standard size because they would not match with old parts in which they are to run. The salvage department can handle the problem of mating parts where the size variation is out a few thousandths, one way or the other. A record can be kept of all machines thus fitted up and they can be classified into groups such as A, B, C, or some similar system. Repairs or renewals to such machines will cause no more trouble than when standard parts are supplied, in most cases, for the standard parts will rarely fit exactly into old parts if any wear has occurred.

—H. MAPLETHORPE, *West Bromwich, England.*

Spending Production Savings on Sales

Saving on production is simple, but, of course, only when you know how to do it. The sales department, however, has to base its calculations on estimates of variable factors that are absolutely outside of its control. It was probably a better proposition for the tractor company to spend all of its extra profits in persuading additional customers to buy tractors than to have the machines on its hands for six months or more.

The directors of a company frequently look with much greater favor on the optimistic estimates of the sales department than on well thought out engineering estimates of the savings possible through investment in modern equipment. Moreover, sales people, especially those who try to appeal to the non-technical mind, waste more money in unintelligent advertising than the engineers are likely to be able to save by introducing methods that cut production costs.

—H. JAMES, *Birmingham, England.*

Hiring Men from Other Shops

The heads of the concern with which the writer has been connected for many years in a supervisor's position have held it as a fixed tradition not to exchange employees with nearby firms. This rule has been a hindrance. On many occasions my own shop would have benefited from the employment of a man who, on account of slackness in a neighboring industry, had been laid off from his job. The management, however, would not sanction the hiring of such men, but would rather get workers from some plant further away.

I could find no real reason for the reluctance of a company to take men from other concerns. It would seem that absolute freedom of action on the part of the individual should be allowed. A working knowledge of psychology and sociology is as necessary to the successful operating of a manufacturing plant as a knowledge of engineering and up-to-date production methods. —J. T. TOWLSON, *London, England.*

Boring 8-Cylinder Motor Blocks

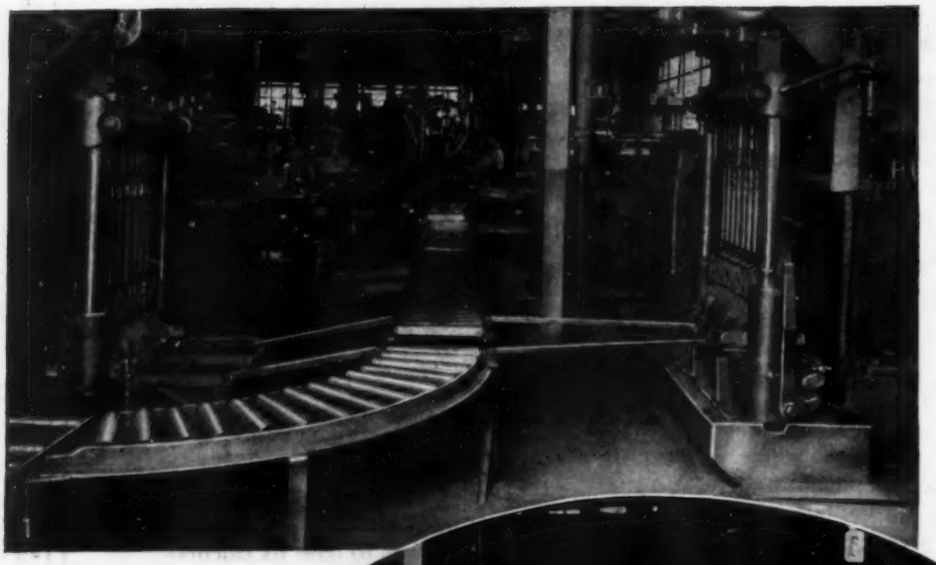


Fig. 1 — Blocks for both the Marmon 68 and the Roosevelt cars are bored in this line. The 68 block goes to the machine on the left and the Roosevelt to the one opposite

Photographs by courtesy of the Marmon Motor Car Company

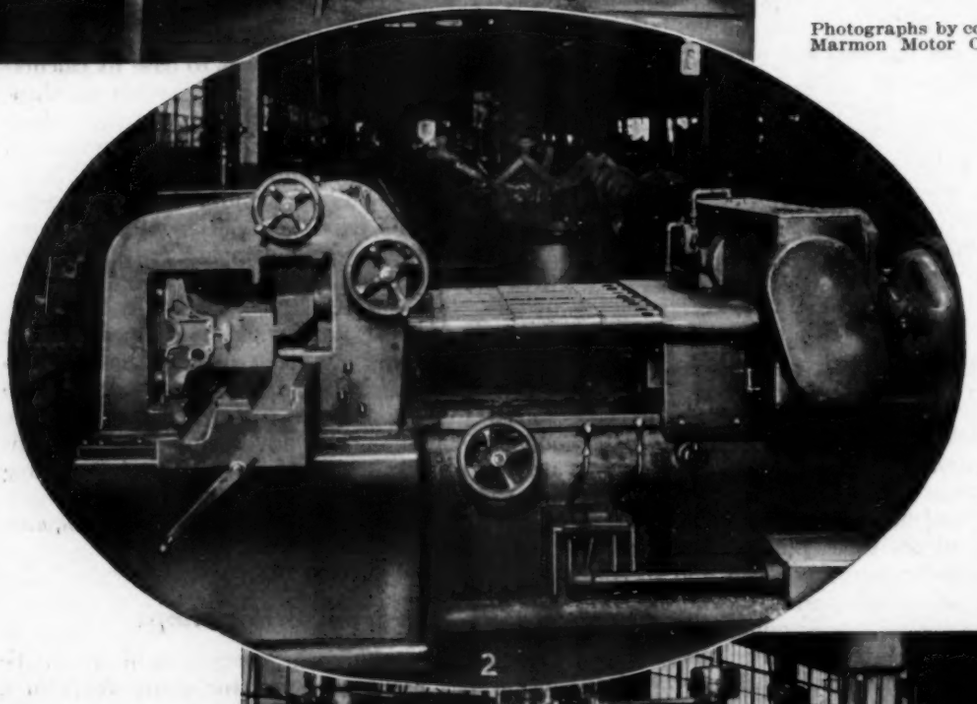


Fig. 2—Cylinder bores are finished on this horizontal machine. The boring bars are supported at both ends in all machines

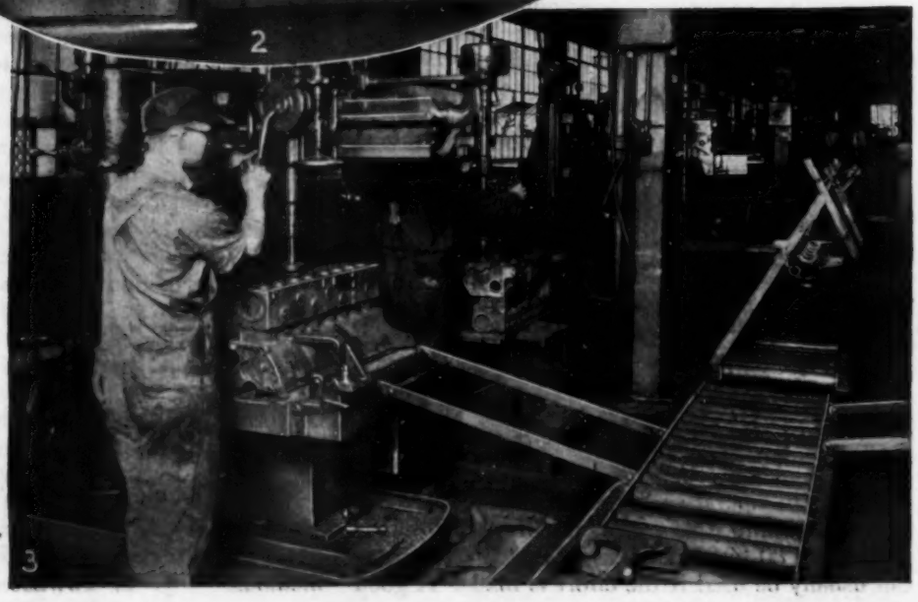


Fig. 3—Finish drilling the blocks under radials. Drill bushings are at each side, and the blocks are handled on steel slides

TOOLS for Small-Lot Production of BRASS PARTS

By Arthur V. O'Brien
Superintendent of Shops, State University of Iowa

The productive capacity of the engine lathe can be greatly increased by a little ingenuity in tooling

The author describes methods and tools intended for the small jobbing shop and the maintenance shop where automatic and turret lathes are not available, and where the production is likely to be small

TO MANY small jobbing-shop owners, and to foremen of maintenance shops in manufacturing plants of all descriptions, there frequently come small lots of brass parts that can be machined very rapidly on an engine lathe equipped with the simple tools herein described. Some of these tools have been originated by the writer during a rather long experience in such work, while some have been borrowed from the experience of others. All of them, however, have been used with considerable success, and while they may be old stuff to many readers, it is hoped that they may prove useful to those of less experience.

One job that comes up frequently in brass finishing is turning and threading to a shoulder, as indicated in Fig. 1. The combined turning and threading tool *A* is easily made, and many jobs can be done with it. It is necessary, of course, to make the spread between the turning and the threading points wide enough so that the threading tool will not interfere with the turning and necking operations. At the same time, the threading point must project beyond the turning point, so that the latter will not score the unturned part of the work while the threading is being done. The tool is used in

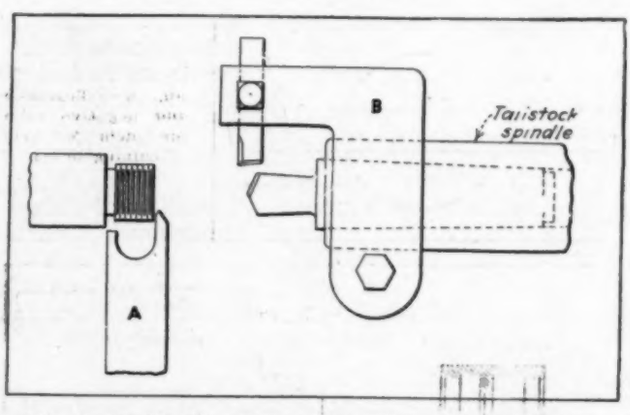


Fig. 1—Combined turning and threading tool, and a holder for turning tools clamped to the tailstock

the double toolpost, illustrated in Fig. 2. This toolpost has been employed in holding tools for turning and threading thousands of pieces without using any sizing stop at the back, the sizing being done by means of the cross-feed dial. The ordinary cross-feed stop at the front is used for the threading tool. The double tool for turning and threading can be used in the front position, and a cut-off tool can be used in the back position when working on bar stock. The tailstock turning-tool at *B*, Fig. 1, is frequently useful when it does not have to be removed to change other tools held in the tailstock spindle. It can be used in conjunction with a short, flat drill in the center hole.

Cross-slide stops may be in any of the common forms, of which the most useful is the hinged type, shown in Fig. 3, with two stops, but which can be made with more. This stop can be used either at the front or the back of the cross-slide as needed. Of the tailstock tools there are many; drills, reamers, taps, dies, and that type of boring tool which, years ago in the Pere Marquette shops at Saginaw, used to be called "former." Whether or not such tools are properly named, it were better to leave to the machine-shop philologists to decide. However, they are very useful tools, and are easily made, though the average machinist is probably not familiar with them.

A cross-section of a special valve-body is shown in Fig. 4 at *A*, while at *B* is the "former" for finishing the inside and facing the end. Many of these valve bodies have been threaded with the tool shown at *C*, in the toolpost, using a hinged stop at the front of the cross-slide. Many have also been threaded by means of the tap and holder to be described later, the tap being turned in by hand.

The steps in making a "former" are indicated in Fig. 5. At *A* is the blank turned to fit the center hole, the stock used being of such size that it can be drawn out to the

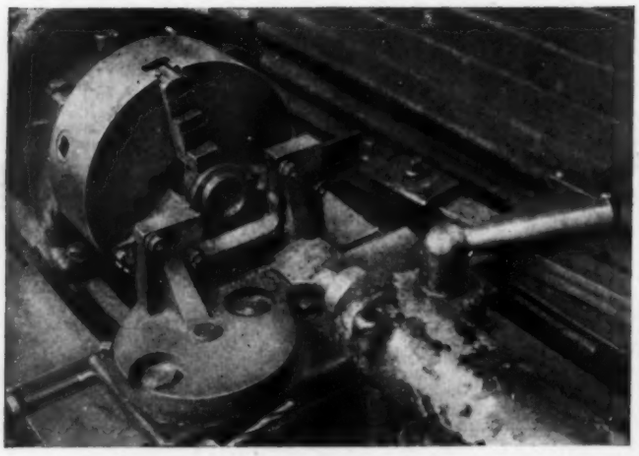


Fig. 2—Double toolpost for cross-slide

form shown at *B*, the thickness being proportioned to the diameter, to give the required strength. With the shank in the center hole of the live spindle, the outside is turned to size and shape, as at *C*, after which the clearance is filed. Since the cutting faces are off-center by half the thickness of the stock, as indicated in Fig. 6, the tool has a negative rake, which generally works well on cast brass. It has sometimes been found better to slope the cutting faces to the center line as indicated by the dotted lines, especially on tools of large diameter, which must be made thick for strength.

While drilling and reaming can often be done more rapidly by a lever-operated tailstock spindle, a tool of the sort just described works with less chatter when used with a screw-operated spindle, and when the spindle is lightly clamped at the end of the cut, especially where large areas are to be faced. For work requiring a high degree of accuracy, such tools may not serve, since, being relieved by hand, their shapes may be slightly changed in the grinding, which is generally done by holding the faces *A* on the side of the grinding wheel.

Several such tools are shown in Fig. 7. At *A* is a tool for boring, facing, and chamfering a brass nut. It has a center point turned on it to guide the tap, which is run in by means of a tap wrench. At *B* is a tool for turning the guide of a special valve bonnet. In this tool, the shank is of soft steel, in which a tool-steel blade is inserted. At *C* is a tool for facing a spherical seat, the tool-steel disk attached to the shank being ground on a mandrel to the correct diameter, with clearance and negative rake. When the cutting edge becomes dull, the disk is ground away at *D* and is turned part of a revolution to bring a new cutting edge in position.

In practice, it has been found that a "former" about 2 in. in diameter can be driven well enough if the shank has a No. 3 Morse taper. It is possible to save time in changing tools if the shanks are made about two-thirds of the standard length, using a loose piece of steel in the spindle hole to make up for the difference in length, so that the tools will be ejected by the screw. The cam-operated, tailstock clamps used on some makes of lathes for clamping the tailstocks to the beds, are great time savers. However, a good substitute, where the usual bolts and nuts are used, is to make special bolts and nuts with coarse threads, by means of which the tailstock can be clamped by a single wrench movement.

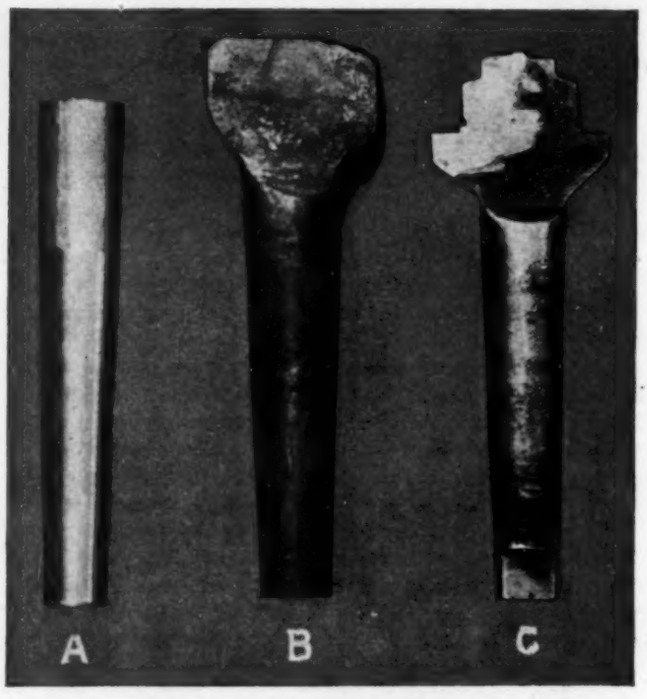


Fig. 5—Steps in making tailstock tools

For holding tools too large to be secured against turning by the taper shanks, a sort of bayonet lock, Fig. 8, has been made, thanks to the idea of a contributor to the *American Machinist*. It is clamped on the tailstock spindle, and each tool has a pin that engages the slot and

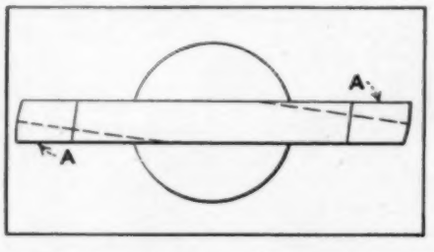


Fig. 6 — Clearance and negative rake for tools for machining brass

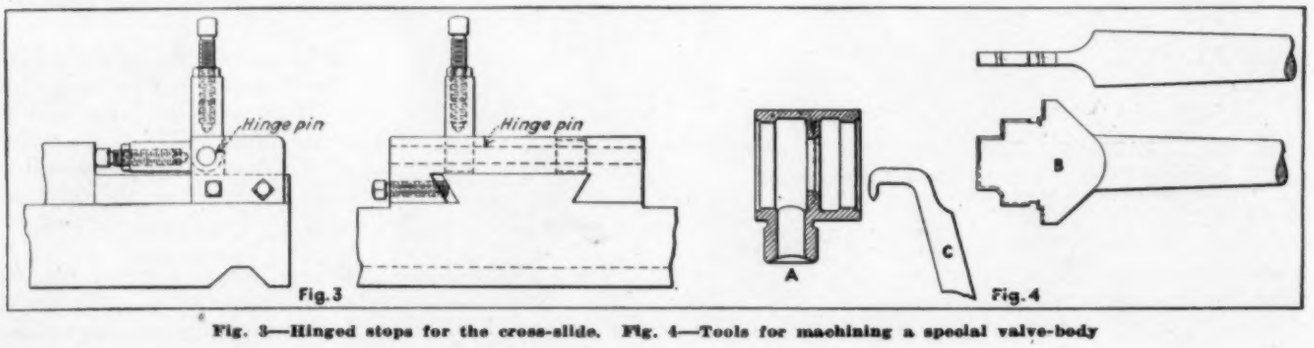


Fig. 3—Hinged stops for the cross-slide. Fig. 4—Tools for machining a special valve-body

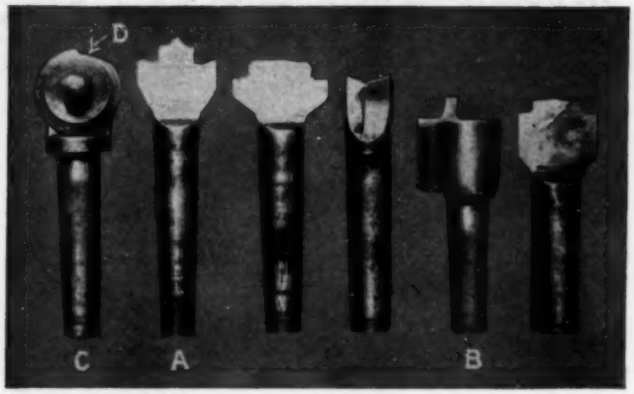


Fig. 7—Several kinds of tools for use in the tailstock spindle

prevents the tool from turning by the pressure of the cut. The pin is made longer than is necessary for merely keeping the tool from turning, so that it forms a short handle, and makes loosening and removing the tool an easy matter.

Small taps can be used in the device shown in Fig. 9, in which the chuck shank is free to turn and slide in the hole in the taper shank. The chuck is held by the hand until the tap reaches its depth; then it is released, and the lathe is stopped and reversed. The chuck is again grasped by the hand, and is held until the tap has backed out. Small dies fitted to a shanked collet can be used in the same way.

Taps too large to be held by hand have been fitted to shanks of the same kind. Such taps are, of course, special and are squared behind the threads, so that they can be run in by using a wrench when the lathe is stopped and the spindle is locked by throwing in the back-gears.

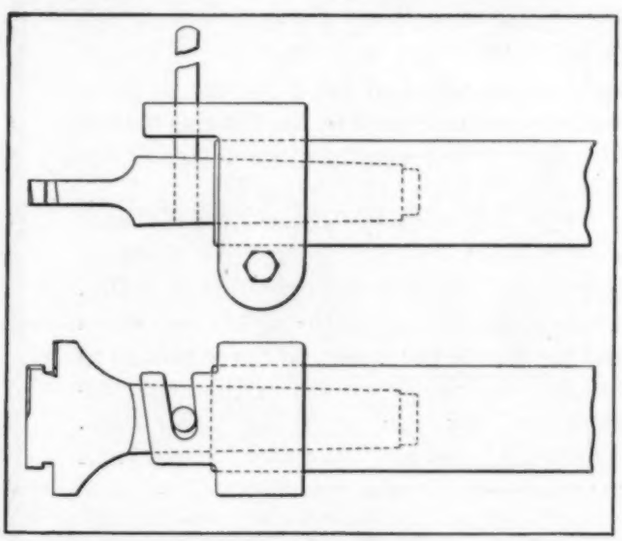


Fig. 8—Bayonet lock for holding tools for turning in the tailstock spindle

The foregoing by no means exhausts the field of time-saving devices that can be applied to the engine lathe. The tools described, and many others, have been made and used in shops so small that a single lathe was the only machine tool, and in larger shops as well. They are offered here with the hope that they may lighten the labors and increase the prestige of some hard-worked machinist who has had to produce a bucket-full of

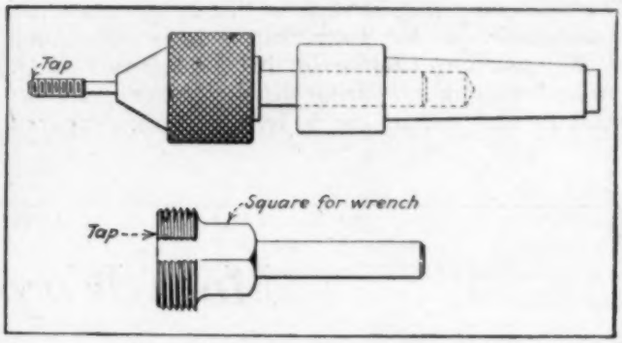


Fig. 9—Sliding shank for a tap holder

gadgets or doo-dads with just the old stand-by on which to do the work.

Small shops are still important factors in the economic structure, and many excellent mechanics are employed in them.

The Small-Shop Foreman As Personnel Man—*Discussion*

By R. G. Hewitt
Wincrest, Yorkshire, England

IN THE *American Machinist*, Vol. 71, page 52, appeared an article by Arthur Mumper who maintains that the human factor is given more consideration in large shops than in smaller ones. In my opinion, the smaller the shop, the more personal contact there will be between the management and the men.

The manager and even the head of the firm not only know all the men by name, but take a personal interest in them, which would be an impossibility in a large shop. Again, when orders fall off, the small shop usually continues working to stock as long as possible. It seems to be a common occurrence, however, in large works, that men are laid off directly a slackening off in orders occurs. This tends to prove that it is easier to remember and to be interested in the human factor in a small shop than in a large one, and the small shop owner almost invariably gives a "square deal."

A foreman with complete mastery over his job and who has gained the respect of his men is not afraid to speak his mind to the management, and if all the foremen are the same, it follows that a high moral standard exists in the works which applauds sensible measures, and disputes unjust ones fearlessly.

It is here that the case presented failed to reach its objective. With beneficial results, the author told the manager not to interfere with the man on the new job. But his prestige went down with a bump in his department, when, on granting an increase, only half of it was allowed by the management. Here is a vital principle of foremanship flaunted openly, and yet he allowed the matter to rest until the consequences, which inevitably follow such actions, slowed up production.

Mr. Mumper's line of action should have been a strong one. A firm presentation of the case to the manager should have had the desired effect. I am convinced that this would have won the case, production would not have suffered, and the foreman's value as personnel man would have gone up.

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions given at the foot of the page have been prepared

THE · FOREMAN'S

More Ways Than One

"WHY all the gloom, Ed?" asked Al on the way home, "Something waiting for you at home besides supper?"

"No, nothing like that in our family, Al, my troubles have the same working hours that I have."

"Well, why not forget them until the whistle blows tomorrow, but in the meantime introduce me to them."

"Same old thing Al—spoiled work; only I don't seem to be able to blame anyone else this time. I guess the job must be getting too big for me."

"It's too big for any man sometimes, old man, but is it serious this time?"

"Not as serious as it will be. We spoiled some long sleeves that we were trying to tap with an Acme thread. We used one finishing and two roughing taps, and only got one good sleeve out of six tries. And that's a darn poor batting average."

"Maybe the tap is not right, Ed. On a double-thread tap, if the difference in angle is not exactly 180 deg. and the same threads do not catch, you are bound to have an oversize thread, or maybe the tool-maker allowed bottom clearance on the shaft thread, too. Why not try some other way?"

"What other way is there? The hole in the sleeve is too small and too long for a milling cutter, or a lathe tool."

"How about making a long tap, starting with a U. S. Standard thread and gradually running into an Acme?"

"It sounds all right, Al, but how long will it be, and how will you take care of the chips and what machine would you put it in? You can't hold it in a tailstock. Come again."

"Well, here's one I saw years ago. A fellow rigged up to hold the sleeve on the tool carriage and carried the tap on both centers of his lathe, driving it with a dog on the face plate."

"That might be all right if the lead screw of the lathe and the lead of the tap were the same, otherwise I would still have a loose thread, I'm afraid."

"Gosh, but you're hard to suit—one more try. How about milling a short nut on the thread miller, and then running the thread back on the tap, and using the nut to get a positive lead that must be the same as that of the tap. If that won't do, the design of the threads will have to be changed."

"That last one sounds best, Al, I can weld a long shank on the tap, turn it down on centers and put it back in the thread miller. Thanks, Al, I'll call up the welding foreman and ask him to put a man on the finishing tap tonight, and while we are machining it tomorrow, they can weld the other two. Thanks, Al, you sure have lifted a load from my mind—until tomorrow anyway."

How many ways are there of cutting an Acme thread? How far does the responsibility of the foreman extend? Is he responsible for results, or only for results that can be secured by the equipment furnished him? Does a foreman worry more than either the engineer or the tool designer? And, if so, why?

Idea suggested by J. A. Potter, Chief Draftsman, Singer Manufacturing Company.

All foremen are urged to discuss these questions vital to their work; of course the

ROUND · TABLE

DISCUSSION OF EARLIER TOPICS

Tempering General Purpose Tools

PROCESS specifications, when compiled from reliable empirical data, and written in clear, concise, unmistakable language, will enable an intelligent operator to produce satisfactory results, provided the automatic control equipment and temperature recording apparatus are periodically checked against reliable standards.

The purpose of automatic controls, and of temperature recording apparatus, is to enable operators to produce and maintain the required operating conditions, and to reduce the excessive labor cost incident to the manual operation and control of furnaces. They usually accomplish their purpose when common sense and vigilance reinforce their application.

A Brinell, or Rockwell, hardness testing apparatus is far more reliable in checking the hardness, or temper, of treated tools than the old-fashioned file method, which depends too much on guess-work and the feel of the operator. Hardness testing, and automatic temperature recording and controlling apparatuses are as necessary to the efficient operation of an up-to-date heat-treating department as micrometers and standardized gages are to the machine-tool operator, even though the latter may claim that he can make as good a job with a pair of spring calipers set to his scale.

—G. A. BAESLACK, *Mfg. Process Engineer, Westinghouse Electric & Manufacturing Company.*

*

Paying a Bonus for Temporary Work

IT IS very discouraging to men who have faithfully given their service to a firm for a number of years, to see new men hired and paid a higher wage than they are receiving for the same work. The new men may be worth more to the firm than some of the older men, but that "cuts no ice" with them. They feel that the firm does not appreciate their service, and they begin to look for another job. A man looking for another job certainly is not going to be of much value to the firm for which he is working. Giving the men a temporary increase does not always answer the problem, for when the increase is taken away from them they are again dissatisfied. If business conditions do not warrant a general increase, about the best way to cope with the situation is to call all of the foremen together and explain to them just what the conditions are.

—W. J. OWENS, *Foreman, Newport Rolling Mill Company.*

Radio in the Shop

WE HAVE a radio in our shop. It is a good one, and the tone quality is nearly perfect. I agree that its influence might be detrimental to the efficiency of the men instead of beneficial. Nevertheless, I think we have found a way of using it that is about as harmless as it can be made.

I have picked out an employee who usually arrives about 30 minutes before starting time. It is his duty to tune in music. The man is instructed to pick out only good music and keep it low. The radio is stopped when the whistle blows. Judging from the comments I have heard the men find it quite pleasing to be greeted with music when they enter the shop in the morning. I doubt whether it increases the day's production, but it certainly is pleasant.

Now, as to the world's series. This is the only baseball event that we attempt to broadcast. We pick out a man who does simple repetitive work. He is equipped with a pair of ear-phones. Before him he has a blackboard and from time to time he marks the score. As this blackboard is so placed that it is visible to all, there is practically no distraction from work.

—A. O. SCHAEFER, *Atlantic Service Company, Inc.*

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Committees for Definite Shop Problems

I BELIEVE that the committees will work out as Al hopes, provided that the management realizes it is not a definite panacea for industrial ills, and that the men selected be given sufficient time to find themselves in their new surroundings. There are many specific problems in industry which are founded on such detailed considerations that a busy executive or foreman cannot give the time necessary to make a proper study of them. If the investigation is delegated to an individual, that individual is often looked upon with mistrust, as a "snooper," and information is withheld or distorted by the men wherever possible. But a committee is above such suspicion and usually enjoys co-operation.

I believe it is well for Williams to attend the meetings, provided he does not act as chairman and, as far as possible, remains in the background. It is just a little unfair to expect the men to develop immediately the executive viewpoint and method of procedure. A little tactful guidance will be of great help in launching the project. Equally essential is a clear definition of the scope and objectives of the committee. Men so selected will invariably be found to be sincere in their efforts, but it is a new field for them, and they are entitled to a little expert counsel. —JOHN W. GARDINER.

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Should We Buy Tools by the Pound?

IF MATERIAL at $1.00 a pound will give $1.00 worth of service, we can use it as a base and say it is worth $1.00. If material costing $500 a pound will give $600 worth of service, it is cheaper than the dollar material. Tool engineers do not measure any material by what it costs to produce or what it sells for per unit. The cost may be lost sight of entirely, as the value is measured

discussion is not limited to foremen. Letters accepted and published will be paid for

only by the service it will give. In other words, we try to buy $600 worth of service for $500 per unit, whether the unit is steel, advertising, legal advice, or recreation. So, if Ed will confine his comparisons to service, the $500 will dwindle down to a mere figure of exchange, and he will be buying service, and not steel.

—W. E. FISCHER.

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The Man Who Shows Interest

IT IS perhaps a little uncommon for workmen to show interest in the work of other departments, but I agree that they should be encouraged when they do. Such men are the best producers because they understand the work better than those men who are familiar with their own work only. I remember a case in our plant. We had to manufacture a large number of locomotive feed-water pumps just at the time when we had introduced the practice of working to tolerance gages. Our men understood the matter in general, but they had difficulty with some of the details. One day a worker who operated a horizontal boring mill visited the department where the pumps were assembled. He was greatly surprised to see that it was possible to take the different pieces from the material containers and assemble them without additional hand work. This man understood instantly the meaning and the advantages that came from using tolerance gages. He was so enthusiastic that his fellow workers afterward made their visit to the assembly department with the same result.

I think all foremen should encourage men who show interest in other things, because a man who knows more about the plant than his own machine will produce better work. —FRANZ BERMANN, *Supt. Locomotive Factory, Austrian Hungarian Licensed Railway, Vienna.*

AS A MAN grows older he should learn more and more about every part of his trade. Many old time machinists will tell you that the only way to do this is to do the work. But this method takes too long to cover many phases of the trade. The best way to acquire experience and knowledge is by studying the proper books and periodicals.

A very excellent way for a man to broaden himself and learn about his trade is to visit the other departments of his plant in his spare time at noon. Without becoming a nuisance he can see how things are done and can decide in his own mind why they are done that way. He will understand better how each operation and job fits into the general plan of things, and can easily realize why certain things are done in what seems to be a peculiar way. He will learn many ideas which he can adapt to the needs of the work he is doing.

If the man should run around during working hours, and neglect his work, his inquisitive habit should be curbed. But a man should be encouraged and aided in any efforts he may make on his own time toward increasing his knowledge and ability, since his value to the firm increases as his fund of knowledge grows. There are too few really good men in any plant to make it advisable to refuse to help anyone toward self improvement.

—L. O. BROWN, *Toolroom Foreman, Holcomb and Hoke Manufacturing Company.*

THE worker who shows enough interest to spend a portion of his noon hour looking over other departments to find what is being made and to see where the work he is doing fits into the finished machine, should be watched as future executive material. This worker is interested in learning all he can, and should not be discouraged in his attempt. Instead, he should be shown the whole plant and the work of the other departments so that his education may be furthered, and his ability, knowledge, and worth to the company increased.

However, in most shops, except among the unskilled workers, there is an understanding of the dependence of one department on the other. This is because of the mechanical nature of the work, for where the product assumes visible form and becomes a tangible quantity, the mind unconsciously follows it through its various processes of manufacture.

—HARRY KAUFMAN, *Public Accountant.*

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THE · NEXT · TOPIC

"What You Do, Or What You Get Done?"

Oil Cups or Force Feed?

SUMMARY OF THE DISCUSSION

Both foremen had been visiting other shops. Upon their return they compared notes on the various things they had observed, among them, machine lubrication methods. One of them had found that the general tendency was towards pressure feed, while the other was positive that sight-feed cups found more favor, and was the most reliable method.

IT WAS not surprising to find a divergence of opinion concerning machine lubrication. The majority of contributors agreed—as one expressed it—that wherever a positive mechanical function can be substituted for a variable one, it should be done. Automatic lubrication was advocated by some, and demanded by others, but the opinions were divided as to whether it should take the form of a pump, with pipes leading to the various bearing surfaces, or a series of distributing plates, with flood pipes for the same purpose. Some contributors maintained that sight-feed oil cups, or hand oiling, properly laid out and supervised, was efficient. It was generally, if not unanimously agreed, that the machine operator, whether working under a day work or an incentive plan, should not be charged with the responsibility of oiling his machine.

One contributor wrote that there was no substitute for careful human supervision, that force feed gave no assurance that oil was circulating, and that sight-feed oil cups were unreliable. Visibility was held to be one of the essentials of positive lubrication, with efficient management as a guarantee of performance.

Large-Scale Washing of Small Metal Parts

By Fred H. Colvin
Editor, American Machinist

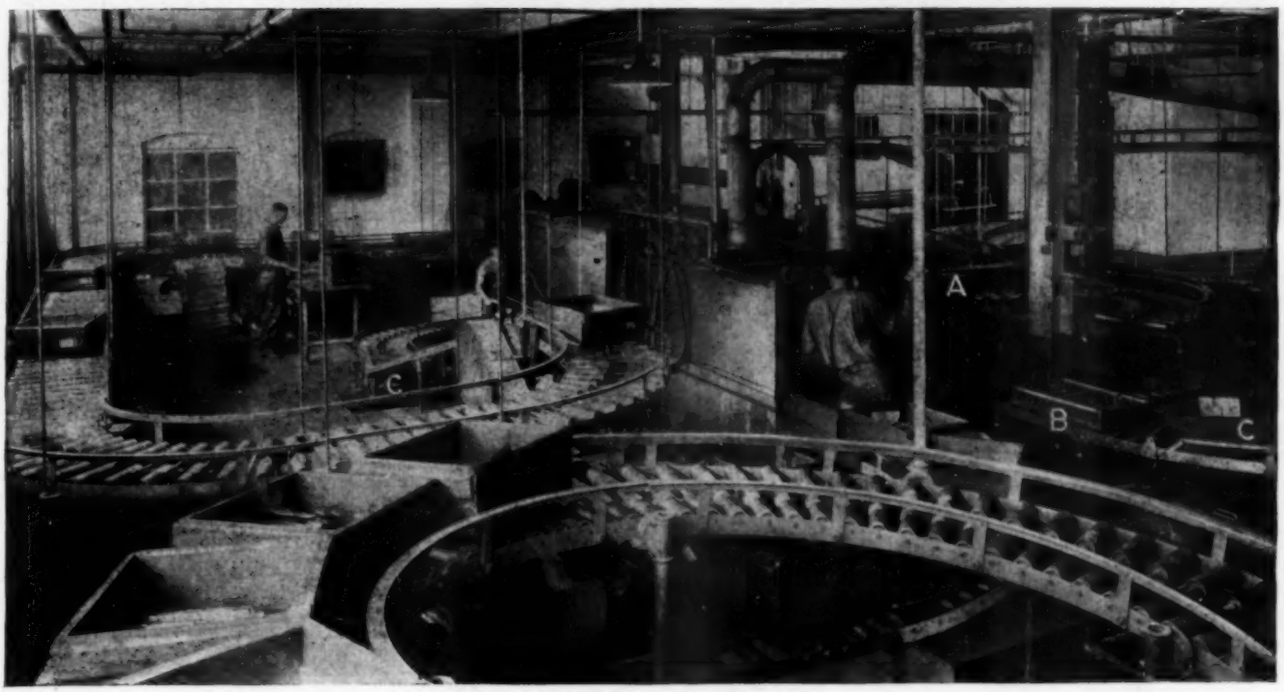


Fig. 1—General view of circular conveyors and their relation to the washing machine

METAL WASHING machines have become fairly common equipment in plants where metal parts of various kinds must be cleaned before going to the assembly department or to prepare them for further operations. In many cases the washing machine is a part of the production line where the parts, such as cylinder blocks, pass through the washer, after machining, on their way to other departments. With screw machine parts and metal stampings it is quite common to have a washing machine as part of the department equipment.

The engineers of the National Cash Register Company, Dayton, Ohio, have attacked the problem in an entirely different manner. Instead of having a washer in each machine department, they have made a washing machine department in which three men, and one washer and dryer combined into a single machine, handle the cleaning of all the parts of the entire plant, except those which go to the heat-treating or enameling department.

It might, at first glance, seem costly to move all material to be washed to one central point. If the movement were done by trucks, even with the most modern power trucks, it might not be wise to centralize the washing in one department as in this case, but with the great extent of gravity conveyors already in use, supplemented by the vertical conveyors that practically make the factory a single-story plant, there seems to be no doubt of the economy of the plant as installed and operated in this particular instance.

Starting with the vertical conveyor on which all of the material comes to the department, they have both the receiving and delivery element of the department concentrated at one point. Boxes of metal parts, varying in size from small screws and pins to bars that are perhaps 18 in. long, come down the vertical conveyor to a dispatcher who sends them, also by conveyor, to the department for which they are intended.

The vertical conveyor and the dispatching point are seen in Fig. 2. The outgoing track from the dispatching point is at *A*, Fig. 3, while the return is at *B*. Between these two conveyors the parts go through the washing machine shown at the right. This view illustrates the thorough use of the space around the washer, the discharge end of both the conveyor, and the rotary washing units.

Parts of all sizes go on the same conveyor, reaching the front end of the washer in Fig. 1 after traveling around the circular conveyor in the foreground. Small parts are fed into a hopper in front of the rotary washer, the operator being shown in the act of dumping one of the boxes at *A*. Large pieces are put into wire baskets

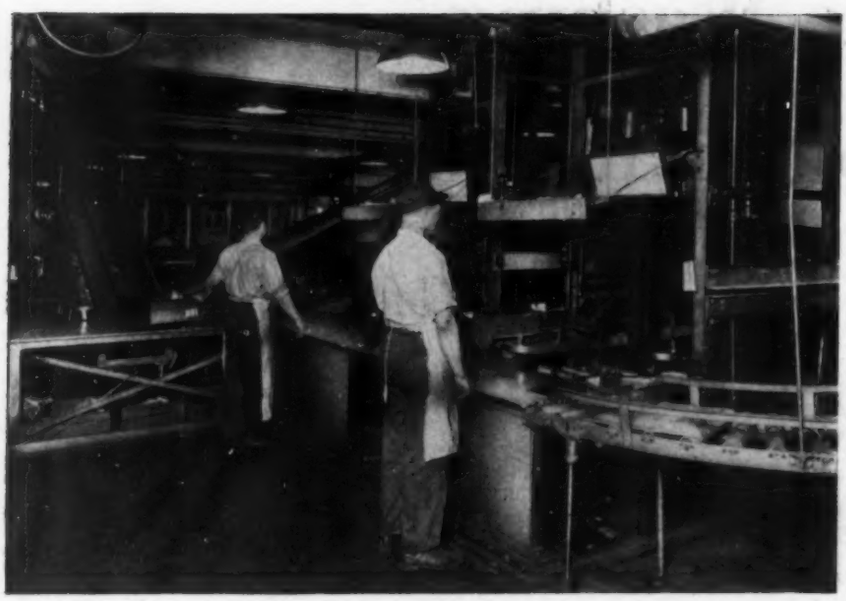


Fig. 2—Vertical conveyor that brings material to the washing department and distributes it after washing

as at *B*. The box from which they are taken is placed on the conveyor as at *C*, Fig. 1, and travels by gravity to the discharge end of the washer on the conveyor *C* in Fig. 3. The wire baskets are returned on another conveyor as at *D*, Fig. 3. The boxes for the parts that are tumbled go on the steeper conveyor *E*, so as to reach the discharge end more rapidly. The circular tracks not only give an easy grade to the conveyor but also act as storage space for boxes in transit. A fourth incline is provided as an excess capacity conveyor in case it becomes necessary. One conveyor slide comes direct from the screw-machine department.

All the parts enter the department through a central point at the foot of the vertical conveyor in Fig. 2. From here the dispatcher sends them to either the tumbling department, or to the new washing machine, as directed on the card in each box. This is accomplished by sending the boxes up on the vertical elevator and discharging them at the incline which takes them to the proper place.

Other inclined roller conveyors bring the boxes back to the same dispatcher after they have been tumbled or cleaned. The card in each box tells where the parts are to be sent; whether back to the department from which they came, or to another for further operations, or to assembly. The conveyor system is so complete that the same vertical conveyor makes it easy for the dispatcher to send them to any floor and to any department of any floor. If the material is suitable for the rotary, or more rapid cleaner, he pours the contents of the box into the hopper and places the box with its work ticket on the incline at *C*. Both the box and ticket are numbered in all cases. This incline lets the box roll to the delivery end of the machine where the receiving operator must have it before the work comes through. As the spiral roller cleaner delivers the work in 40 sec., no time can be lost in getting the box to the other end. But, although the time is short, the operator has his motions so timed that he does not appear to be unduly hurried. He not only moves the box into position under the delivery chute of the rotary cleaner, but he places a clean piece of paper in the box, and after it is filled sees that the work corresponds with the ticket, and pushes the box onto the conveyor that carries it to the inclined belt which in turn elevates it to another roller conveyor that returns it to the vertical conveyor for distribution to its proper department. In Fig. 4 the delivery end is shown.

Work that cannot be handled satisfactorily by the rotary cleaner is dumped into wire baskets or racks as illustrated in Fig. 1. These wire baskets go on the horizontal conveyor at the right and pass under hot jets of cleansing solution, as do those in the rotary washer. This method requires a longer interval in the machine, the flat conveyor being timed to pass work through to the other end in 3½ minutes.

In the meantime the boxes from which the parts were dumped are placed on conveyor *C* which carries them to the discharge end at a slower rate, but so timed as to reach the discharge end opening in ample time to receive the parts as they come through. The wire baskets, after the materials are put back into the box in which they belong, are returned by conveyor *D*, Fig. 3, to the operator at the intake end of the washer.

Observing the rapidity with which small parts are discharged from the rotary washer, it would seem as though there would be danger of mixing the contents of different boxes. But the interval that elapses between dumping the contents into the hopper, placing the empty box on

Fig. 3—Discharge end of washing machine showing how compactly the conveyors are located to conserve time and space

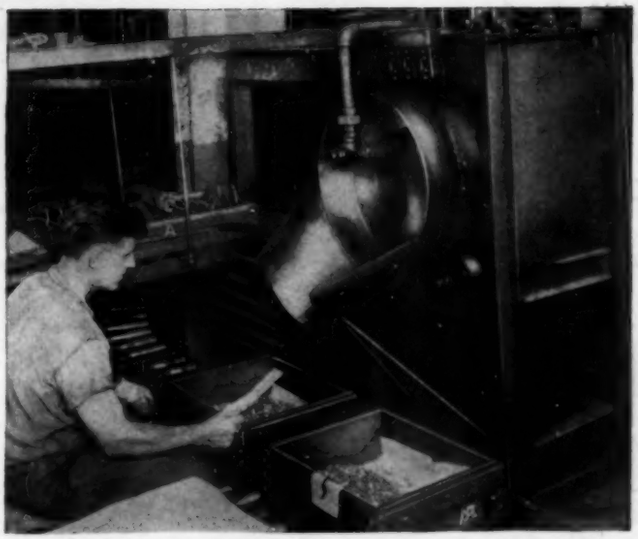


Fig. 4—Close-up of discharge end of washer, showing how the large pieces go straight through while the work from the rotary rolls directly into the boxes

the conveyor, and dumping the next box, separates the contents of the boxes very effectually.

The work washed on the flat conveyor is kept separate as at *A*, Fig. 4. Some of it must be placed on racks, before going back to its department, to prevent injuring corners and ends. These parts go by conveyor to a third member of the group, stationed at a bench, behind the man at the discharge end.

The location of all three men can be seen in Fig. 1, the third man being at the bench at the left. This view also shows how the flat piece conveyor ends at the bench, the filled boxes being placed on the conveyor at the operator's left. The empty baskets go back on the lower conveyor. Boxes from the rotary washer roll down the conveyor to the power-driven belt on the incline at *C*, Fig. 1. This deposits them on the roller conveyor at the top which carries them near the wall, past the third man, and back to the dispatching point in Fig. 2. The boxes which this third man fills roll down still another short conveyor and join the others after the boxes have gone up the incline, Fig. 2, on their way back to the vertical conveyor.

Controls at each end of the washer enable it to be stopped instantly by men at either end. This makes it possible to prevent parts being discharged on the conveyors and floor in case the boxes should not be in place to receive them. The mechanism can, however, only be started from the receiving end.

An analysis of the performance of the washing machine shows some startling figures as to material handled. In one day the three men washed and dried, 2,126 boxes of parts, the boxes containing an average of 40 lb. each. This makes a total of more than 42 tons. In one hour they handled 305 boxes or 12,200 lb. The average for the day, however, was 236 boxes, or a trifle under 5 tons an hour. In one single minute, the best of the day, they handled 5 boxes, or 200 lb., while the average was 3.9 boxes, or 156 lb. per minute.

Great care has been exercised to place conveyors at the most convenient height to avoid unnecessary labor in every way. Conveyors are used wherever possible, and where lifting must be done the distance has been reduced to a minimum. The three men work on a group bonus, help each other whenever possible, and save about 30 per cent over the former methods.

Aside from the results secured in washing the material shown, this installation is an excellent study in a carefully planned conveyor layout. Almost every available inch has been utilized, both in the matter of floor space and the area in the air above. The whole layout can be studied to advantage by anyone wishing to bring a large quantity of material of many kinds into a single department for any purpose whatever, and to distribute it again to the departments from which it came, or to send it elsewhere. As an example of co-operation between the engineering and plant layout departments and co-operation with the department directly involved, it has few equals

Indifference to the Apprentice System—*Discussion*

By W. R. Needham
Engineer, Design Department, English Electric Company, Ltd.

THE article "Wanted a Mechanic," by H. M. Darling, on page 921, and Chas. E. Dawson's discussion under the title heading, on page 931, Vol. 70, of the *American Machinist*, calls attention to a matter which is likely to become of the utmost gravity. In fact, the race of old millwrights and high-grade mechanics seems to be in danger of dying out.

What must be realized is that there is still abundant scope for craftsmanship and mechanical adaptability of the first order in modern engineering. Certain crafts call for exceptional skill and for considerable mental ability. Men in the toolroom and the pattern shop, for example, have to be able to read drawings with almost draftsmanlike facility. The latter, too, have to be workshop draftsmen. The gager and marker in machine and structural shops, are capable draftsmen, while the maintenance gang contains men of the soundest "horse sense" and ambition.

It is not always realized that there is such scope in an ordinary engineering workshop. Men of proven ability, and those who do well because they love their job, will always be in demand. They constitute the aristocracy of labor. Such men often make admirable foremen, and not infrequently succeed splendidly as managers of repair shops and the like.

But it is not only necessary to encourage responsible apprenticeship; it is up to employers to encourage apprentices. A good job well done is worth a good return, and the surest inducement is to make the payment bear some rational relationship to the quality and importance and worth of the work. Where unskilled men can earn almost as much as skilled, many argue naturally enough, "then why spend years in learning?" The remedy is obvious.

Some wise man has said: "There are, and always will be, more jobs for the man than men for the job. Human selfishness, if no other agency, will prevent a man of ability from languishing in idleness."

A Modern Railroad Toolroom

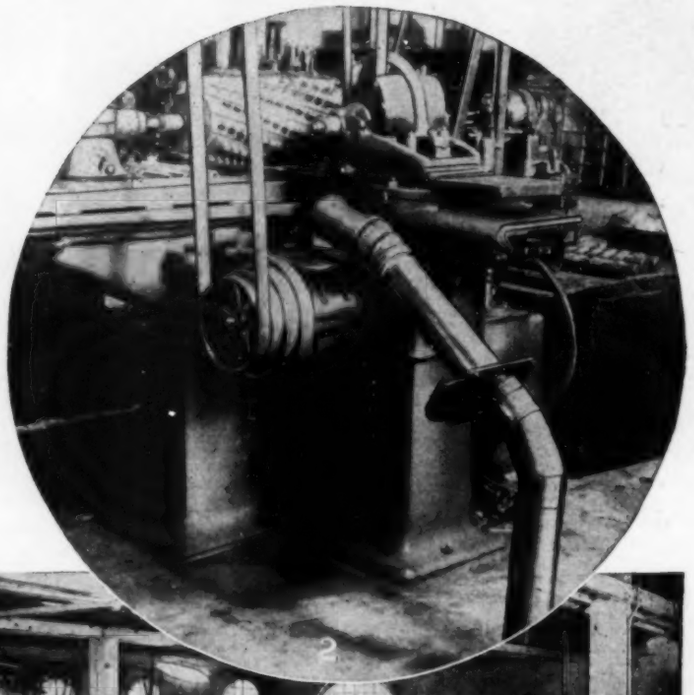


Fig. 1—A general view of the toolroom showing the arrangement of the machinery. Ample working space, and modern equipment are features. At the lower right is shown the lathe section, while at the left-hand side of the illustration is shown the milling machine equipment. At the rear, in the center of the illustration, is the grinding section. The heat-treating equipment is located in a separate section of the toolroom

Photographs by courtesy of the Sacramento shops of the Southern Pacific Railroad

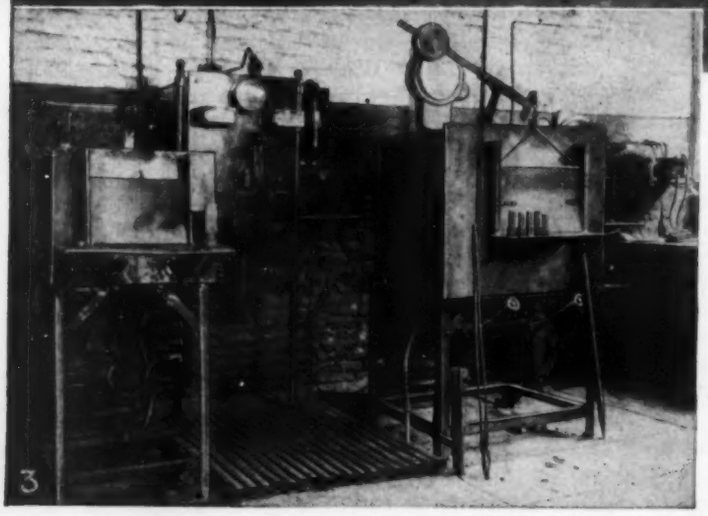


Fig. 2—One of the cylindrical grinding machines set up for sharpening an inserted blade slab-milling cutter. Abrasive dust is withdrawn from the machine by an exhaust system, consisting of a fan driven by a 7½-hp. motor, and arranged with three outlet pipes running parallel under the floor

Fig. 3—Two of the furnaces used in connection with the heat-treatment of tools. The one at the right is for the treatment of high-speed steel, and can accommodate parts requiring temperatures up to 2,400 deg. F. The left-hand furnace is for annealing and hardening miscellaneous parts

CONTROLLING MANUFACTURE
By Economic Lot Sizes

By Fairfield E. Raymond

Assistant Professor of Industrial Research, Massachusetts Institute of Technology

PRODUCTION executives are continuously in a quandary as to what quantity should be produced in any single manufacturing lot. If the executive is production minded, he will tend to produce the largest quantity, in order that his preparation costs may be most widely distributed and that the ultimate unit cost shall be the lowest attainable. If he is financially minded, he will tend to produce the smallest quantity, because he realizes that the least amount of capital will be required for manufacturing operations and that a much more rapid turn-over of capital can be obtained. Executives of both types are correct, but the situation demands that the attitude of each should be considered in determining the best lot quantity to produce under any given manufacturing conditions.

An economic balance must exist between the total preparation cost for each lot and the total investment charges incurred by the storage of the articles thus produced while awaiting eventual consumption on future orders to assure the minimum-cost quantity. Accordingly, the best quantity to produce will be that for which a unit allotment of the preparation cost to each article will be equal to the unit storage investment charge, because only at this point does the ultimate unit cost become the minimum. From this, a simple definition for the minimum-cost quantity can be derived, and the quantity can be determined from the expression for the minimum point of the ultimate-unit-cost curve. However, a study of the conditions makes it evident that the preparation costs are really a group of charges which accumulate to the lot or production order irrespective of the size or quantity produced; while the investment charges are typical of a group which can be reduced directly to unit charges, as they depend entirely upon the quantity produced. The second group may be considered as containing all charges that should be added logically to the cost of manufacture at the instant the articles are removed from stores and that are not included with the unit manufacturing cost as a part of the value of the articles upon which the investment charges are based.

Economic-Production Quantity Defined

An economic-production quantity may be defined as that quantity which can be produced at the lowest total unit cost consistent with an economic use of capital in its manufacture, taking into consideration the preparation charges against each process order, investment charges on the capital involved, rental charges on the space occupied by the article while carried in stock, possible losses due to deterioration and obsolescence, and the nature of the process.

The numerical value of the economic-production quantity can be obtained from that for the minimum-cost quantity by means of a corrective factor which takes into account the fact that any increase in the manufacturing cost which is due to the production of this smaller quantity is exactly offset by the reduction in capital charges, because of the smaller amount of invested capital required. In this way, the manufacturing advantage is maintained as the gross profit derived from the sale of such articles, and is in no way diminished by the resulting increase in cost. As the advantage in both cases is the best attainable, the larger or minimum-cost quantity and the smaller or economic-production quantity evidently must be the upper and lower limits of the economic range which lies between them.

A Standard for Production Control

Naturally, the economic-production quantity will become the standard for the control of production in all cases, because it takes into account both the conservation of capital and the necessary protection from obsolescence, besides assuring the maximum return upon the capital employed. Economic quantities can be applied both to the fabrication of parts and to assemblies where the process is intermittent. As a large number of fabricated parts enter into any assembled unit and as it is possible that any number of these parts may be used in a variety of assemblies, an economic quantity must be determined for the assembly operations independent of that for each of the fabricated parts.

Again, the principle of economic-production quantities can be applied to purchasing raw material or finished parts which are used in the various assembly processes; and the quantity can be determined in this case in a similar way. Economic-production quantities will be found of considerable value, also, in production analyses and in determining the best method of manufacture.

The application of economic quantities can be adapted to any intermittent process to investigate controlling factors which are unusually obscure, so that the need for finished parts or sub-assembly stores can be eventually dispensed with. Determination of the size of the production lot under these new circumstances may show that an intermittent process can be transformed into a continuous process even though the manufacturing equipment must remain idle during certain periods. In each case, the reduction of the manufacturing cost due to continuous production must offset the carrying charges for the idle machines.

Determination of the limits of the economic range need not be included in the routine of the production control department, since they are in the form of standards and are not a specific quantity which is applicable only to the control of production at the immediate instant. It would be preferable to have the computations for these limits made by the process engineers at the

Abstract of a paper entitled "Manufacturing Control through Economic Size of Production Lots" presented at the Production Meeting of the S.A.E., Cleveland, Oct. 2 to 4.

time when the process is planned originally, as the required data will be more readily available from the production and cost records in their possession. The numerical values of these limits can be obtained by substituting the indicated data. In the general formulas, as given at the head of Tables 1 and 2, in the Reference Book Sheet in the *American Machinist*, Vol. 71, No. 18. Equation 1, in Table 1, is for the economic quantity, Q_e; and equation 2, in Table 2, is for the minimum-cost quantity, Q_m.

In actual practice, both of these expressions should be simplified to suit the conditions pertaining to the specific industry or product before any attempt is made to introduce the data for a given problem. The denominator of each equation is composed of the sum of three groups of terms. These groups may be designated as elements, of which the first accounts for the influence of the investment charge on articles in stores, the second for the influence of the investment charge on work in process, and the third for the influence of the space charges incurred by articles in stores.

Principles Will Assist Process Engineers

Aside from the advantages gained through the control of production, the principles underlying the economic-production quantity can be of considerable assistance to process engineers in their analysis of manufacturing operations, because the limits of the economic range are based upon standard conditions typical of the process as established at the time of its adoption. The economic quantity can be used as a basis for the allotment of certain total charges in the computation of predetermined costs which in themselves are a standard measure of the efficiency of the process. If there is a choice of several methods of manufacture, the economic quantities and the proposed unit costs for all may be determined and compared, in order to select that process which will yield ultimately the lowest unit cost for production. Expensive tools, jigs and fixtures that might yield remarkably low costs in large-volume production might not earn their cost, if applied to manufacturing the same articles at their current rate of consumption, before the utility of the article is changed because of design obsolescence. Therefore a less highly refined process may be most economical for a lot of moderate size.

Choice of machines can be made best with a knowledge of the most economical quantity that can be produced upon those machines; and their adoption may be justified, even though they may at times be idle, provided the size of the manufacturing lot is sufficient. The space allotted to the manufacture of any article depends upon the type of equipment employed as well as the quantity that is to be placed beside each machine during its operation; therefore, the lay-out of the process also depends upon the economic quantity.

Extending production analysis to a consideration of the best method of scheduling, a reduction in the number of manufacturing periods can be attained if the economic size of lot will permit a larger quantity for production than has been customary previously, provided the application of the principle has achieved a reduction in investment charges or improved the manufacturing cost of the article so that the total amount of working capital employed will not be greater. If the saving of time due to the elimination of set-ups is sufficient, an increase in working capital may be justified. Moreover, production schedules for fabricated parts can be prepared in advance.

Selection of material-handling equipment often depends upon the number of articles to be moved in any one time, as well as the nature of the article. The size of the lot will then determine the most economical size of the container or may indicate that conveyors should be provided.

Any accounting method will be applicable to the collection of cost figures entering into the predetermined cost which will be used in the calculation of both the minimum-cost quantity and the economic quantity. However, care must be taken not to include any item which appears in one element in the value of any other element employed in either the numerator or denominator, except where specifically indicated in the formula. For convenience, the entire numerator will be considered as a single element depending upon the preparation charges. The reason for this is that the economic balance depends upon an equality between those elements which contain factors independent of the quantity but dependent upon the total lot, and those elements which contain factors entirely dependent on the quantity.

Another distinction that must be borne in mind is the difference between the interest rate i and the expected normal rate of return from capital employed in production r, when used in conjunction as a corrective factor for the conservation of such capital in the determination of an economic quantity and when the interest rate i is used alone for computing the cost of the capital employed in determining the minimum-cost quantity. In this case, the cost of capital represented by these investment charges, both on stock and on work in process, should be computed from the interest rate which would normally be paid for the use of borrowed capital whether the capital is actually borrowed or not.

General adoption of economic lot sizes in industry has been delayed by the fact that a number of fallacies have arisen in the interpretation of the data required. The most serious has been the use of the rate of production in determining the proportion of any lot which can be diverted directly from the process to current sales orders. Instead, the rate of delivery to stores, D, should be used.

Production Rate Is Often Unknown

In few cases is the production rate for the whole process known, whereas the unit production time for any piece can be found in the cost records or production records, if time studies have been made and wage rates set. Obviously, it will be more convenient to obtain the sum of these unit-production times for each operation and use this as the total unit time for the production of each piece, rather than to try to compute the total production rate and derive a time factor from that.

Some executives do not wish to include overhead in prime cost; and, when prime cost without overhead is used in place of the unit-production cost c, including overhead, the resulting figure for the economic quantity will be inordinately large. The original purpose of these executives is to be conservative by keeping down inventory values, but the smaller valuation for inventory purposes serves to increase considerably the quantity that the economic theory of production seems to allow, and consequently makes actual inventory values greater than they would be if overhead had been included in the unit-production cost.

Supplying Materials on Time Through Advance Planning

By F. M. A'HEARN
Assistant General Foreman, Bessemer & Lake Erie Railroad

UNLESS there is advance planning of locomotive and car maintenance programs, the necessary materials, outside of those of a standard nature, either must be ordered largely by guess work, or must be ordered as the progress of the work warrants. Unless some advance planning is practiced, there remains two alternatives: Excessive stocks of materials on hand at all times, or quantities ordered when their necessity becomes apparent.

The first course means an excessive and unnecessary amount of slow-moving materials, and a condition detrimental to the successful operation of the purchase and stores department; the other, unwarranted material delays with attendant serious handicaps to shop operation. Either course, directly or indirectly, is certain to increase maintenance of equipment costs, and eventually reflect itself in the net earnings of the carrier.

A rapid turnover of materials, with idle items at a minimum is the objective of the storekeeper; suitable materials available when and where needed is the requirement of the shop men. Combined then, we find the common objective to be a rapid turnover of materials without material delays. To attain or even to make only partial attempts to attain this goal, there must exist a definite understanding and co-ordination of effort between the two departments.

Were perfection possible in anything, we could safely state that material delays could be avoided entirely by advance planning of locomotive and car repair programs; at the same time stock requirements could be brought to a point where the only duty of the supply department would be to secure materials and at once turn them over to the consumer for immediate application. Perfection, however, is not attainable. Therefore, some idle materials will always be on hand and some delays for materials are bound to occur.

It has been demonstrated on a number of leading railroads that material delays may be practically, if not entirely, eliminated by advance planning. The fact that material delays are avoided while a satisfactory turnover of material is being secured is proof in itself that it is the most economical, as well as the most satisfactory, method of carrying out repair programs.

It also appears to be the general belief among purchases and stores officials that delays for materials are invariably due to lack of a sufficient time interval between forwarding information covering the mechanical department needs and the date when it is proposed to apply the material. The exception is in the case of those items generally used on all classes of locomotives or on all classes of cars. Such items, when kept in stock and ordered by the purchases and stores department in the usual manner, will be subject to rapid depletion if an unusual amount of any item is drawn during the course of repair programs. This obstacle may be avoided by treating these standard materials in the same manner as special materials, or semi-special materials.

Authorities agree that the purchases and stores department should have at least 90 days advance notice of the plans of the mechanical department, in order that they may make necessary preparation for the accumulation of materials for the repair program.

We find that it is considered advantageous to make an effort to handle all classified repairs of a given type of locomotives or cars at certain shops. When two or more locomotives of the same type are being repaired at the same shop, substitution or transfer of materials from one unit to another may be accomplished, if necessity demands. This action would be practically impossible were the two locomotives being overhauled at the same time in two different shops. The method also has the advantage that all materials for the repair program to that certain class of power, may be consigned in advance to a given point instead of being rehandled.

Another aid to the furtherance of advance planning is a very accurate record of equipment conditions. Some carriers compile a monthly record of the condition of each locomotive. From this condition report, together with a tentative mileage, a shopping date is established. Large items, as well as new applications, are noted in connection with the date when shopping is to occur.

It is considered by some carriers advisable, in addition to giving the stores department the 90 day advance notice above referred to, to again check up 60 days and 30 days prior to the proposed shopping date in order to acquaint the supply department with any additional developments in the way of material requirements not included in the original report.

It seems generally agreed that a material program to be effective should originate either with some designated officer, or with a committee who are empowered to assign to locomotives and cars the additions and betterments authorized by the management. The information should be passed along to all interested subordinate officers until it reaches the department directly responsible for the application of the material. Each officer in his turn should enlarge upon the detail information in order to round out a complete program. Suitable forms should be provided and delayed materials traced and forwarded. Any unfinished materials which are to made ready for application before the shopping date should be on hand a sufficient time in advance to permit finishing operations without interfering with other work.

Where repair programs are carried on in the manner outlined, there is invariably a tendency for the mechanical department to anticipate the use of too much, rather than too little material. Where such a condition occurs, it is an advantage that the entire class of locomotives or cars are being repaired at the one point, as the delivery of material may then be halted until the consumer has used up the material he first considered necessary.

[1] Abstract of a report entitled "Reducing Material Delays by Proper Programming," presented at the convention of the International Railway General Foremen's Association, Chicago, Sept. 17 to 20.

Production Methods in the Railroad Shop

By A. E. IVESON

General Foreman, West Albany Locomotive Shop, New York Central Railroad

WITH ever-increasing government regulations and the competition now being offered by automotive vehicles, railroads must use every means at hand to cut the cost of operation. Naturally the non-revenue producing departments, such as the locomotive and car repair shops, are driven the hardest to curtail their operation costs.

Mass production has solved this problem in industrial plants of all kinds, and it would seem to be the logical method to employ in railroad shops, but conditions existing in car and locomotive repair work are such that mass production can only be practiced on a very limited scale.

STANDARDIZATION OF REPAIR PARTS DIFFICULT

There are many different classes of locomotives and cars, making standardization of repair parts a difficult problem. Production must be governed by consumption, and it is of little value to produce in large quantities, material that will be carried by the stores department for months at a time, steadily increasing the cost, but never increasing the value. Manufactured material that has been paid for and not put to work at once, soon swallows up its value in storage, handling and inventory, and for that reason it is unprofitable to manufacture repair parts in quantities when the demand for them is far less than the supply. There are some instances, however, where decided savings can be made.

For example, shoes and wedge faces on driving boxes can be machined four at one setting on a 2-spindle horizontal milling machine, using face milling cutters and a jig for the purpose. This method shows a saving of 75 per cent over the old method of planing.

A turret lathe has been placed on the market recently, which promises to be a great aid in producing bolts efficiently and economically that will fit holes they are intended for, whether the holes be tapered or straight. This is accomplished by measuring the hole with plug gages and setting the micrometer dial on the machine to correspond to the micrometer graduations on the gage. These bolts can be turned with one cut correct in both diameter and taper, showing 75 per cent saving over the old method of finishing on engine lathes.

The value of wheel lathes, tire mills, multiple bolt machines, forging machines, and electric flue welders, is well known as a factor in economical shop operation, and they might be classed as profitable single purpose machines, because the demand for their products is always ahead of the supply and insures continuous operation.

However, cost cutting is not a question of machines alone, improved working methods have proven a valuable factor in this important subject. The most important development in this line is the progressive system of car repair work. This plan has brought about a revolution in car repairing in practically all parts of the country. It has increased railroad shop production to such an extent as to insure its superiority over any of the older methods. In shops where it was an effort previously to maintain a schedule of 100 to 125 cars per month, it is now possible to turn out 350 to 400 cars per month, with approximately the same labor allotment on actual construction. Under the progressive plan, cars are worked through the shops in a certain number of spottings, depending on shop facilities and on the construction of cars undergoing repairs at each spot, such as stripping, truck work, draft gear, steel work, safety appliances, painting, and similar jobs. A reasonable time allowance is set for each spotting, and it can be seen readily that a delay at any certain spot means the tying up of the line, resulting in lost man-hours at each of the other spots. Of course, at times and under certain conditions, it is necessary to increase the force on some particular spot in order to prevent such delays. However, if a certain class of equipment is moving through the line, the forces can be gaged in such a manner as to make such delays a rarity.

The major contributing factors in shop savings through this progressive plan are: First, material is placed adjacent to the spot where it is to be utilized and, second, each group of workmen has one particular line of work and a specified limited time to perform it; hence, these men become skilled and efficient in that particular line.

In working certain series of cars through the shops, mill work and fabrication is for that particular class of equipment. After machines are set for this work, no changes are necessary until another class of cars is started through the line. There is no question that the progressive plan, so successful in industrial plants, will eventually become successful in railroad repair shops.

TRANSPORTATION OFTEN NEGLECTED

In the rush of production, one feature of economical shop operation that is too often neglected is the transportation of supplies and raw and finished products. At no point in shop operation is there a call for more efficient or scientific handling than in this same department, regardless of it being equipped with modern tools and machinery for producing parts in quantities for locomotive and car repairs. The efficiency of modern methods is useless if the means for distributing the finished material are insufficient.

Overhead cranes, air and electric hoists might be classed as fixed conveyors, because of their limited range. Electric, platform and crane trucks, also hand trucks, constitute the more flexible style of conveyors in use.

The flexibility of the electric truck makes it a most important factor in handling material. Especially is this true of the crane truck, since it releases the overhead crane for the heavier work.

The expansion of the "Safety First" idea has been remarkably large during recent years. It brings about a great saving in so far as shop production is concerned. The results of these safety measures are to be seen in the fact that workmen are remaining on duty and not being forced to lay off on account of minor or major injuries. This means more man-hours devoted to production. It also avoids the necessity of placing a green man on the job, which, whenever necessary, tends to slow up production.

Abstract of a paper entitled "Savings in the Railroad Shop by Modern Shop Production Methods," presented at the meeting of the International Railway General Foreman's Association, Chicago, Sept. 17 to 20.

IDEAS FROM PRACTICAL MEN

The department, "IDEAS FROM PRACTICAL MEN," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

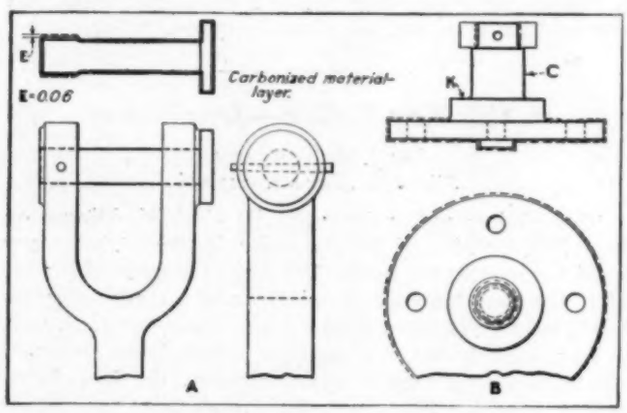
Selective Casehardening of Locomotive Parts

BY FRANZ BERMANN
Supt. Locomotive Factory, Austrian Hungarian State Railway Company, Vienna

There are many cases in the locomotive building industry where it is desirable to case harden bolts, lever forks and similar parts selectively so that certain surfaces may be machined afterward. The usual method of doing this is to copper plate the surface that is to be left soft, but such facilities are not always at hand. Sometimes, when the shape permits, a fireclay paste is used to cover the surface.

In the case of the lever fork, shown at *A* in the illustration, it is desired to drill and ream one end of the bolt for a taper pin after it has been assembled to the fork. The method I use is to leave the diameter of the part to remain soft enough larger, so that when it is reduced to the diameter of the rest of the bolt, the carburized surface will have been removed. In the present instance, the hardened case is to be 0.06 in. thick. The diameter of the end to be left soft must, therefore, be greater than its finished diameter by 0.12 in., plus a slight margin of safety.

The bolts are packed for carburizing, and heated in the usual way, but are allowed to cool in the carburizing pots. After the cooling, the end to be left soft is turned down to the required size, and the part is reheated to the hardening temperature and quenched in water. The bolt is then assembled to the fork, and drilled and reamed for the taper pin.



Typical examples of local casehardened parts

That this process can be extended to any surface that can be machined is illustrated in the example at *B*. This part is a flanged fulcrum pin that is bolted to the locomotive frame with four bolts. It is desired to harden and grind the surfaces *C* and *K*, and leave the rest of the piece soft. In order to do this, the part is rough turned all over except the surfaces *C* and *K*, which are turned down to the sizes allowed for grinding. The piece is carburized, cooled in the pot, and a cut is taken over the surfaces that are to be left soft. It is then heated and quenched and the surfaces *C* and *K* are ground. This principle can be used in many places, and in some cases it has an advantage over copper plating.

Gage for Setting Brake Lever Arms

BY CHARLES F. HENRY

In order to facilitate the setting of brake levers and brackets so that the brakes can be adjusted easily and quickly, the assembly department of the Marmon plant has devised the gage shown. The upper plate rests in

Gage for setting arms for 4-wheel brakes

a given position on the top of the frame, and a hole in the vertical projection permits the location of the arm by the pin shown. With the upper arm against the pin the split hub is tightened on its shaft by the clamping bolt illustrated. By removing the pin the arm movement can be tested readily. It is easily made and conveniently used.

Boring a Curved Hole—*Discussion*

BY H. C. CARD
Production Manager, Vendex, Inc.

The article with the above title on page 182, Vol. 71, of *American Machinist* reminded me of a similar job which was done at the plant of the Taft-Pierce Manufacturing Company.

A man, whose name I have forgotten, called and wanted a curved cylinder, and a piston to fit it. These were wanted for a steam engine which was going to

"revolutionize" steam engine design. The theory was that a curved cylinder would keep the thrust of the piston at approximately 90 deg. with the crankshaft during about 90 per cent of the stroke.

This man said he had been "turned down" by some of the most prominent firms in the country. He was told by the Taft-Pierce officials that it would simply be a waste of money, but he insisted on having the job done if it could be done.

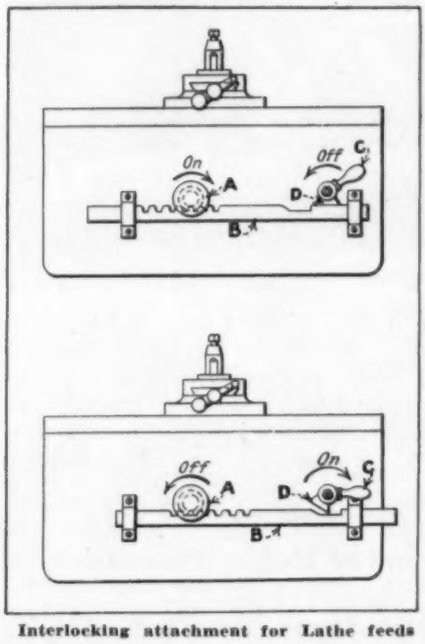
The cylinder was cast in flanged sections which were bolted together after the flanges were faced and bolt holes drilled. A hollow, curved iron casting was made, provided with a bearing with means for holding a single-point boring tool at the end of the curved portion. This casting was clamped to the column of a milling machine and the tool driven from the spindle of the milling machine by means of shafts and bevel gears mounted inside of the curved portion. The cylinder was mounted on a circular table and fed past the tool by rotating the circular table.

The piston was machined in the same way, substituting a turning tool which revolved around the outside of the piston. I do not remember how the piston was clamped while being turned, but it was probably on a stud set into an angle iron.

Preventing Damage to a Lathe

By R. H. Kasper
Master Mechanic, Steel Heddle Manufacturing Company

In the shop where I am employed, a lathe that is used mostly by apprentices frequently suffered damage, due to the lead screw and the longitudinal feed being engaged at the same time. In order to remedy the trouble, the attachment shown in the illustration was placed on the carriage apron, so that it would be impossible to engage either feed while the other was already engaged.



Interlocking attachment for Lathe feeds

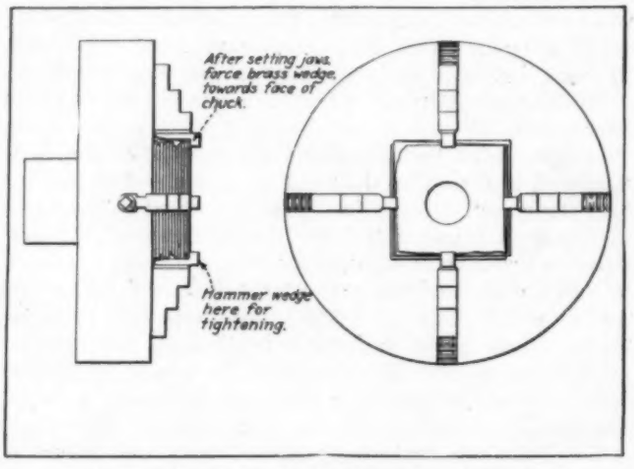
Knob *A* engages the longitudinal feed and carries a pinion that engages the rack teeth cut in the bar *B*, which is held to the apron by cleats. Lever *C* brings the half-nuts and the head screw into engagement, and carries the triangular piece *D*. In the upper view, the longitudinal feed is shown engaged. Turning the knob *A* in the direction of the arrow to engage the longitudinal feed, causes the bar *B* to move to the left. With the bar in this position, part *D* prevents the half-nuts from being engaged, as it cannot clear the rack bar.

In the lower view, the lead screw and the half-nuts are engaged by turning the lever *C* in the direction of the arrow. Since the longitudinal feed is disengaged, the position of bar *B* is such that part *D* swings into the clearance space cut in the bar. Should the knob *A* be turned while the lever *C* is in the engaged position, the end of the cut-out section in bar *B* will strike the part *D*, preventing sufficient movement of the knob *A* to engage the longitudinal feed.

Holding Irregular Shaped Disks in a Lathe Chuck

By Fred Ladwig
Detroit Screw Works

A quantity of irregular shaped disks may be held in the jaws of an ordinary lathe chuck by the method shown in the illustration. It is not necessary that the pieces be of the same size or shape, but they must, of course, be



Holding irregular-shaped disks in a lathe chuck

within the capacity of the chuck. The wedges shown at *A* may be held to the chuck jaws by clips, and after the jaws have been closed as far as possible without bending the disks, the wedges are driven in towards the face of the chuck until the sheet forms a compact bundle. In this position, they can be drilled or bored.

A Gib-Key Puller—*Discussion*

By J. T. Towlson
Silvertown, London, England

The gib-key puller described by Carl M. Dinger on page 799, Vol. 70, of the *American Machinist*, has many good features. I agree that the main elements of his design, the loop, the rod, the weight, and the nut are good, but I would not class it as an entirely dependable tool.

In some cases the key might be driven home so nearly up to the head that it would prevent the loop being placed over it. Such a condition rules out the device, and recourse must be had to steel wedges and good square packing pieces. Even where there is room, I believe that it will be found difficult to prevent the loop slipping off the head of the key. This may be prevented, however, by filing the back of the head concave, or by filing the contact end of the loop, so that a blow has a tendency to force it down, instead of raising it.

Stub Spur Gear Diameters

With Working Clearance or Running Allowance Made

Number of Teeth	12/14 Pitch			14/16 Pitch			16/18 Pitch		
	Root Diameter	Pitch Diameter	Outside Diameter	Root Diameter	Pitch Diameter	Outside Diameter	Root Diameter	Pitch Diameter	Outside Diameter
12	0.816	1.000	1.138	0.697	0.857	0.978	0.607	0.750	0.857
13	0.899	1.083	1.221	0.769	0.929	1.050	0.670	0.813	0.920
14	0.983	1.167	1.305	0.840	1.000	1.121	0.732	0.875	0.982
15	1.066	1.250	1.388	0.911	1.071	1.192	0.795	0.938	1.045
16	1.149	1.333	1.471	0.983	1.143	1.264	0.857	1.000	1.107
17	1.233	1.417	1.555	1.054	1.214	1.335	0.920	1.063	1.170
18	1.316	1.500	1.638	1.126	1.286	1.407	0.982	1.125	1.232
19	1.399	1.583	1.721	1.197	1.357	1.478	1.045	1.188	1.295
20	1.483	1.667	1.805	1.269	1.429	1.550	1.107	1.250	1.357
21	1.566	1.750	1.888	1.340	1.500	1.621	1.170	1.313	1.420
22	1.649	1.833	1.971	1.411	1.571	1.692	1.232	1.375	1.482
23	1.733	1.917	2.055	1.483	1.643	1.764	1.295	1.438	1.545
24	1.816	2.000	2.138	1.554	1.714	1.835	1.357	1.500	1.607
25	1.890	2.083	2.221	1.626	1.786	1.907	1.420	1.563	1.670
26	1.983	2.167	2.305	1.697	1.857	1.978	1.482	1.625	1.732
27	2.066	2.250	2.388	1.769	1.929	2.050	1.545	1.688	1.795
28	2.149	2.333	2.471	1.840	2.000	2.121	1.607	1.750	1.857
29	2.233	2.417	2.555	1.911	2.071	2.192	1.670	1.813	1.920
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32	2.483	2.667	2.805	2.126	2.286	2.407	1.857	2.000	2.107
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34	2.649	2.833	2.971	2.269	2.429	2.550	1.982	2.125	2.232
35	2.733	2.917	3.055	2.340	2.500	2.621	2.045	2.188	2.295
36	2.816	3.000	3.138	2.411	2.571	2.692	2.107	2.250	2.357
37	2.899	3.083	3.221	2.483	2.643	2.764	2.170	2.313	2.420
38	2.983	3.167	3.305	2.554	2.714	2.835	2.232	2.375	2.482
39	3.066	3.250	3.388	2.626	2.786	2.907	2.295	2.438	2.545
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45	3.566	3.750	3.888	3.054	3.214	3.335	2.670	2.813	2.920
46	3.649	3.833	3.971	3.126	3.286	3.407	2.732	2.875	2.982
47	3.733	3.917	4.055	3.197	3.357	3.478	2.795	2.938	3.045
48	3.816	4.000	4.138	3.269	3.429	3.550	2.857	3.000	3.107
49	3.899	4.083	4.221	3.340	3.500	3.621	2.920	3.063	3.170
50	3.983	4.167	4.305	3.411	3.571	3.692	2.982	3.125	3.232
51	4.066	4.250	4.388	3.483	3.643	3.764	3.045	3.188	3.295
52	4.149	4.333	4.471	3.554	3.714	3.835	3.107	3.250	3.357
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60	4.816	5.000	5.138	4.126	4.286	4.407	3.607	3.750	3.857
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73	5.899	6.083	6.221	5.054	5.214	5.335	4.420	4.563	4.670
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77	6.233	6.417	6.555	5.340	5.500	5.621	4.670	4.813	4.920
78	6.316	6.500	6.638	5.411	5.571	5.692	4.732	4.875	4.982
79	6.399	6.583	6.721	5.483	5.643	5.764	4.795	4.938	5.045
80	6.483	6.667	6.805	5.554	5.714	5.835	4.857	5.000	5.107
81	6.566	6.750	6.888	5.626	5.786	5.907	4.920	5.063	5.170
82	6.649	6.833	6.971	5.697	5.857	5.978	4.982	5.125	5.232
83	6.733	6.917	7.055	5.769	5.929	6.050	5.045	5.188	5.295
84	6.816	7.000	7.138	5.840	6.000	6.121	5.107	5.250	5.357
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91	7.399	7.583	7.721	6.340	6.500	6.621	5.545	5.688	5.795
92	7.483	7.667	7.805	6.411	6.571	6.692	5.607	5.750	5.857
93	7.566	7.750	7.888	6.483	6.643	6.764	5.670	5.813	5.920
94	7.649	7.833	7.971	6.554	6.714	6.835	5.732	5.875	5.982
95	7.733	7.917	8.055	6.626	6.786	6.907	5.795	5.938	6.045
96	7.816	8.000	8.138	6.697	6.857	6.978	5.857	6.000	6.107
97	7.899	8.083	8.221	6.769	6.929	7.050	5.920	6.063	6.170
98	7.983	8.167	8.305	6.840	7.000	7.121	5.982	6.125	6.232
99	8.066	8.250	8.388	6.911	7.071	7.192	6.045	6.188	6.295
100	8.149	8.333	8.471	6.983	7.143	7.264	6.107	6.250	6.357

Contributed by A. Washauer, Standardization Engineer, The Ingersoll Milling Machine Company

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All in an Upper Room

UPSTAIRS in the White House is a little room. Abraham Lincoln had it for his study. There, during the feverish days and nights of September, 1862, the Emancipation Proclamation was born.

From 1865 to 1929 this room became bedroom, storeroom, catch-all. Not until we had a president with the Quaker's true sense for the inner worth of common things did anyone care a whit for its serene quiet and modest historicity. Mr. Hoover refurbished this upper room. Again it is the study of the President.

* * *

Late evening, October 7, 1929, long after most of the guests had left the great state dinner, Mr. Hoover asked Mr. MacDonald to come upstairs to the study. We can almost hear him saying, "Let's have a little smoke before we go to bed."

They sat before the fireplace, the Prime Minister of the British Empire and the President of the United States—just like any two everyday men in any comfortable room. Almost oblivious of two or three other men who had come upstairs with them, they looked into the fire, and thought, and talked. They respected, and liked, and enjoyed each other.

This is diplomacy that any man can understand—and trust.

*

Encouraging Competition

ENCOURAGING competition among vendors with a desire to secure better service, better product, and lower prices, is the natural order of business. Without some sort of an urge, improvements are few and far between. Whether it be the urge of the inventor to try something new, or of the manufacturer to increase his business and his profits, we have better products in all lines. Large buyers encourage competition by dividing their business, and by pitting one vendor against another. It is questionable, however, as to how far this practice can be carried with good results.

Ultimate profit is the legitimate and necessary aim of all business, and profit depends largely on the volume of business. Splitting business so that each vendor gets a small order frequently means that none get enough to make the order profitable.

Then, too, manufacturers of products for general consumption think only in terms of large production. They all too frequently overlook the fact that the greatest possible market for some special machines is limited to a very few hundred, and this number must be spread over several years. Encouraging competition in such cases is a questionable practice, unless much more efficient machines can be secured.

In a few cases, at least, the pirating of special machines has been encouraged even where patents were involved. Aside from ethical considerations, this is questionable practice. Successful high-production machines cannot be designed and built in every shop, particularly by those who are content to copy other men's ideas. And unless the real designers and builders are permitted to profit by their labors, they will seek other fields, as has been done in at least one instance. Could there be a better example of killing the goose that laid the golden egg?

*

The Soviet Farm Problem

FROM the noise he makes, or which his self-appointed spokesmen make for him, one would readily concede that the only real farm problem in the world is the one centering around the American farmer. Yet there are other farm problems equally pressing, not the least of them being the one that faces the Soviet Russian administrators.

In Russia the farmers, or peasants, make up perhaps two thirds of the population. In the United States there are relatively but half that number. And, although the Russian peasant now has the land that he has wanted so long, and therefore has satisfied his major craving, he is beginning to gather the idea that he is being exploited in favor of the industrial worker. As a consequence he is scaling down his crop production to but little more than enough for his own needs.

Washington may be concerned about the American farmer and his troubles, but its worries are but flea bites when compared with the Russian problem of appeasing those who make up the majority of the populace.

SHOP EQUIPMENT NEWS

Boye & Emmes "Coneless" 16-Inch Engine Lathe

A SELECTIVE headstock known as the "Coneless" is used on the 16-in. lathe announced by the Boye & Emmes Machine Tool Company, Cincinnati, Ohio. This headstock is shown in Fig. 2, and employs thirteen gears giving twelve spindle speeds from 15 to 402 r.p.m. Gears and clutches are of heat-treated alloy steel, oil hardened and drawn to a Brinell hardness of 461-477. The gears have wide faces and the clutches slide on multiple-splined shafts. All shafts are of S.A.E. 3250 steel, heat-treated. Bearings on both sides support the headstock, instead of up against the bearing caps. The face gear and pinion are of the herringbone type. A quick-change gearbox furnishes forty changes of thread leads or feeds. These changes can be made without binding action on any of the levers. By changing two gears on the quadrant, odd threads can be cut. All gears in the box are of alloy steel.

A box-section apron is employed and all gears are supported on both sides. They are of alloy steel. Cross feed and longitudinal feed frictions are of the cone type and self-adjusting. An interlocking arrangement prevents engaging the half nuts while the feed is engaged. One oil reservoir lubricates the entire apron.

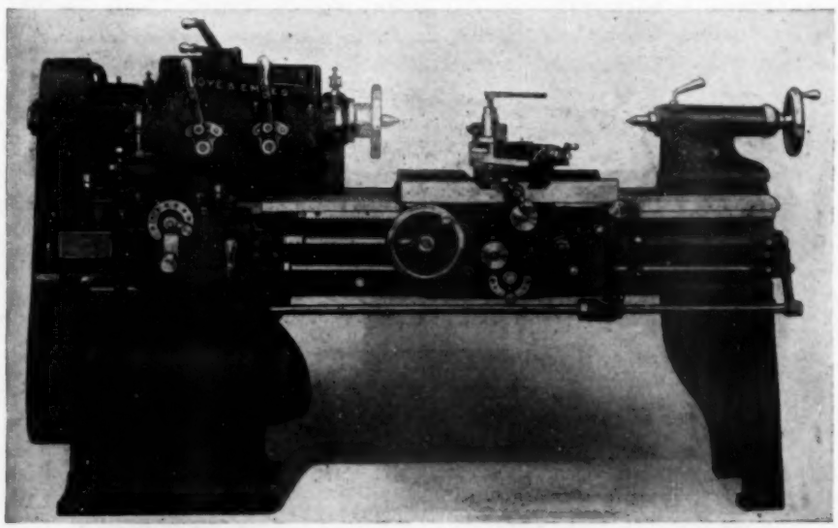


Fig. 1—Front view of the Boye & Emmes 16-Inch "Coneless" Engine Lathe

driving pulley with its multiple-disk clutch.

An alloy steel forging is used for the spindle and the lapped journals are large in diameter. Phosphor-bronze spindle bearings are usually furnished, but anti-friction bearings for the spindle can be had at extra cost. Thrust collars are hardened, ground and lapped, avoiding any camming action of the spindle.

Back-gears are mounted in front of the spindle and are used for eight of the twelve speeds. By placing the back-shaft and gears in this position, the pressure is down against the

Heavy construction is a feature of the carriage, which has a wide bridge, avoiding any twisting action under heavy cuts. The carriage slides on two V-ways and is scraped to a bearing its entire length. Felt wipers are furnished at either end. A follower rest can be furnished as an extra. It straddles the bridge of the carriage and is bolted to both sides. The carriage is drilled and tapped to receive the follower rest at any time.

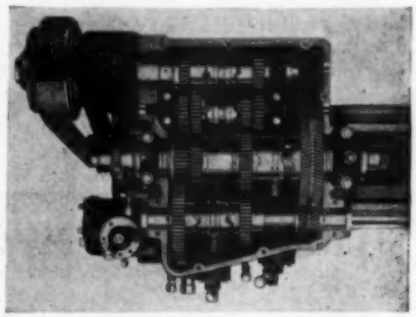


Fig. 2—Headstock with cover removed

Cabinet leg mounting of the motor on an adjustable plate is used to provide means for tensioning the belt or chain. Drives can be arranged for a flat belt, multiple V-belts, or silent chain. The lathe also can be furnished for single pulley drive from a lineshaft or countershaft.

Standard equipment consists of large and small faceplates, steadyrest with 5-in. opening, toolpost, and necessary wrenches. A taper attachment may be bolted and doweled securely to the back of the carriage. It is heavily constructed. The tool-rest slide connection to the taper attachment is a one-piece casting, thus minimizing side strain or twisting action when turning tapers. The

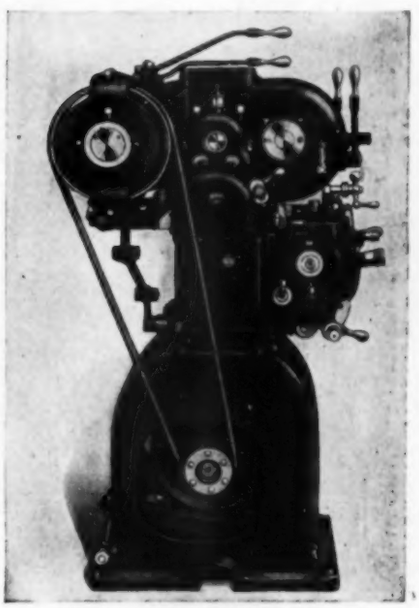


Fig. 3—End view showing the flat belt drive

taper attachment will turn to an included angle of 12 deg. per foot or 2½ in., and it will turn 15 in. at one setting. The carriage is drilled and tapped to receive the taper attachment at any time.

Specifications are as follows: Swing over the bed, 18½ in.; swing over the carriage bridge, 12½ in.; swing over the compound rest, plain bottom, 11¼ in., swing over the taper attachment, 10⅜ in.; hole in spindle, $1\frac{9}{16}$ in. in diameter; diameter of the nose, 2¾ in.; Morse taper, No. 4; travel of compound rest top slide, 4 in., size of tool steel used, ⅝x1¼ in.; feeds per revolution of feed rod, from 0.004 to 0.112 in., range of screw threads per inch, from 2 to 56; floor space required for the 6-ft. bed, 32 in. x 7 ft., and the approximate weight, 3,000 pounds.

"Cobly" No. 55 Metal-Sawing Machine

A METAL-SAWING machine designated as the "Cobly" No. 55 is announced by the Cochrane-Bly Company, Rochester, N. Y. The bed and carriage ways are cast integral and are mounted in a deep pan which provides ample chip space and a reservoir for the coolant.

Taper gibs compensate for wear and prevent any lifting of the carriage. The saw arbor is hardened and ground and mounted in roller bearings. The arbor gear and pinion, with herringbone teeth, are hardened, and these with the phosphor-bronze worm gear and hardened steel worm are fully inclosed and run in oil. The carriage can be adjusted by hand either to or from the work.

Drive is through a friction clutch operated from either front or side position, and a sliding gear transmission giving four cutting speeds of 42, 60, 75 and 90 ft. per min. The driven pulley and all drive shafts are mounted in roller bearings, and the worm thrust is taken by a Timken high-angle thrust bearing. The drive gears are hardened and run in oil. The worm has triple lead, 1-in. pitch and is a drive fit on the shaft, which during carriage travel, slides through a sleeve gear in the gearbox. This sleeve gear is hardened, has herringbone teeth and is mounted in Timken roller bearings.

The feed screw is mounted above the ways in line with the center of the saw arbor and close up to the blade in line with the cutting and frictional resistance so as to minimize tendency to lift or cant the carriage and cause vibration or a variation in feed. The feed screw nut is split and provided with adjusting screws to compensate for wear. Lock nuts are provided to compensate for wear where the feed screw connects with the housing of the gearbox.

The sixteen changes of feed are entirely independent of speeds and any feed is applicable to any speed. The feed clutch can be operated from either the front or side working positions. Adjustable stops regulate the length of carriage travel and trip the feed into reverse giving automatic quick return of carriage. The feed can be stopped at any point without going into reverse and without stopping the machine. The feed gear train has a flexible clutch which slips under excessive load, and a shear pin in the feed screw gear provides a double safety.

The vise has two clamp screws, either one of which is sufficient for holding single round bars. The vee-block has a 90-deg. included angle, and suitable for round, square or rectangular bars. The vise may be fitted with a 60-deg. vee-block and yoke for holding small round bars in multiple. For this work the vise is usually furnished with three clamp screws, one of which is outside of the

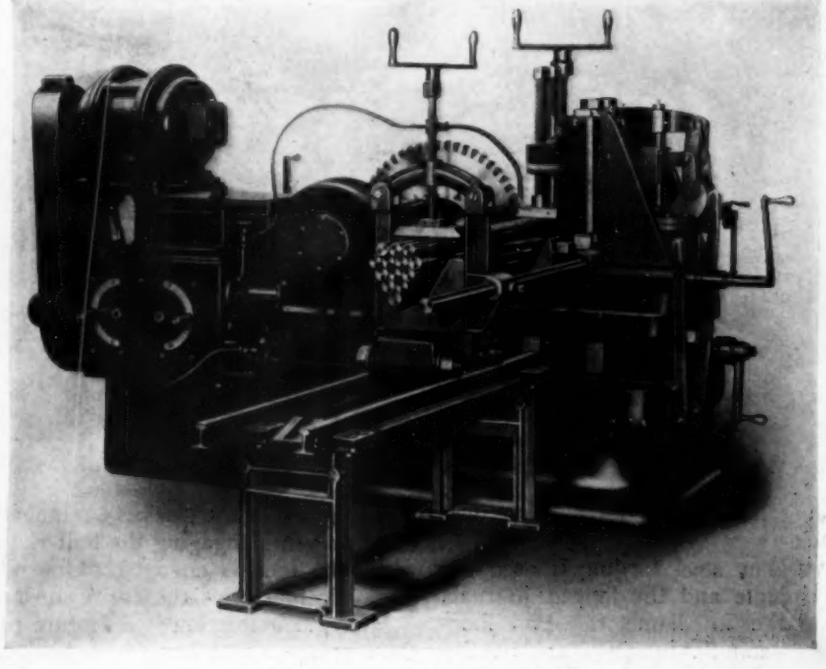
SPECIFICATIONS

CAPACITY:	
Round bars	7½ in.
Square bars	6½ in.
I-Beams	10 in.
Rectangular sections	5x10 in.

CAPACITY OF 60-DEG. FIXTURES FOR MULTIPLE CUTTING

¼-Inch bars	76
⅜-Inch bars	43
1- Inch bars	26
1¼-Inch bars	13
1½-Inch bars	13
2- Inch bars	8
2½-Inch bars	4
3- Inch bars	4
3½-Inch bars	1

Diameter of saw blade	24 in.
Cutting speeds (ft. per min.)	42-60-75-90
Feeds (16 changes), inches per min.	¼ in. to 10 in.
Size of work table	21 in. x 22 in.
Height of work table	24 in.
Speed of drive shaft	400
Diameter and wide of drive pulley	18 in. x 5¾ in.
Motor required, 7½ hp	1,200 r.p.m.
Floor space	36 in. x 96 in.
Weight, net	4,500 lb.



"Cobly" No. 55 Metal-Sawing Machine

saw blade to hold the cut pieces and prevent leaving a prong where the blade cuts through. An air clamp can be furnished in place of standard screw vise.

The stock feed consists of a stock support truck on rails and a draw rack and pinion operated with a crank. The standard rack is 24 in. long and has gage collars which can be set for the length of piece to be cut plus the thickness of blade. Draw racks can be furnished up to 8 ft. in length, and any length of track with suitable stock support trucks and Vee-blocks of correct angle for either the loading or cutting side of machine.

Power stock feeding and unloading apparatus can also be furnished for this machine. Motor drive is by silent chain or Texrope, with motor mounted above the machine. Chain and sprockets are fully inclosed.

Barnes No. 221½ Production-Type, All-Geared, Drilling and Tapping Machine

ARRANGED for drilling 1½-in. holes in mild steel to the center of a 22-in. circle, the No. 221½ production type, self-oiling, all-geared driller and tapper has been placed on the market by the Barnes Drill Company, Rockford, Ill. Eight speeds and eight feeds that may be changed quickly are obtained through the control levers shown in Fig. 2. This view also shows the indexing plate and the graduated movable collar for setting the spindle travel. The drive pulley speed is 400 r.p.m., but this may be increased if desired. A ratio of 4 to 1 is given by the back gears.

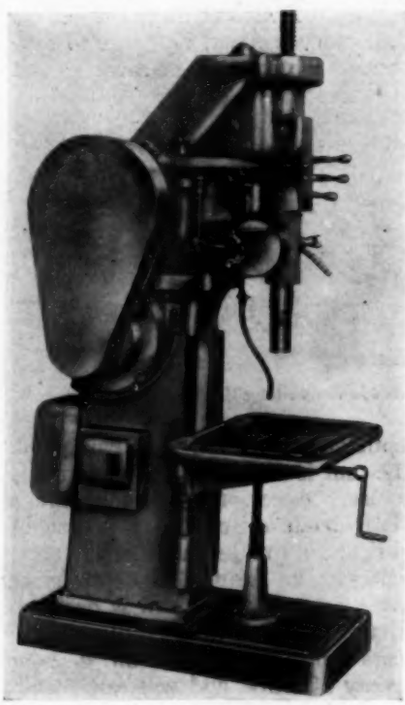


Fig. 1—Barnes No. 221½ Production-Type, Self-Oiling, All-Geared, Drilling and Tapping Machine, showing the inclosed Texrope drive. The motor is mounted in the column

The principal feature is the use of Nitralloy steel for the spindle and sleeve, both of which are hardened after machining by the nitriding process, giving a hard case about $\frac{1}{32}$ in. deep. This permits the spindle to run directly on roller bearings, which are self-oiling, and which contact directly upon the hardened surfaces of the spindle and sleeve. No race way is used, and rollers are held in cages inserted in recesses at each end of the steel sleeve. The diameter of the sleeve is therefore held to 3½ in. Rack teeth are cut integral in the sleeve, wholly within the circle, and the torque is taken by hardened collars which roll in the milled channel at each end of the rack teeth. No graduations appear on the hardened sleeve to indicate the spindle travel, but, instead, a graduated ring is used and this is mounted on the internal gear, the graduations being equivalent to inches of spindle travel. Spindle movement is obtained through a star wheel and internal gear construction, the same as on other machines manufactured by the company. The sleeve is fully inclosed in the housing between the crown gear and sleeve bearings and the sleeve housing is split, having a Gunite cap with laminated shims for convenient take-up.

Timken bearings are used on all speed change shafts and for the spiral crown gears. Ball bearings are employed for the drive shaft and for the handwheel shaft. Speed change gears are cut from chrome-nickel steel and are heat-treated. Crown gears are of forged steel having spiral teeth and are hardened. Threaded collars are used for adjustment of the Timken bearings. Six-splined shafts are used for sliding gears and for the 1⅜-in. main spindle. An automatic reverse feature for tapping is quick in action,

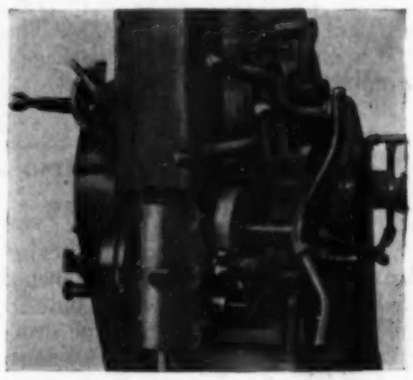


Fig. 2—Close-up from the front showing the feed and speed change levers and the indexing plates, also the graduated, movable collar for setting the spindle travel

giving the reverse speed in the ratio of 1¾ to 1.

The drive is by means of Texropes properly guarded as shown in Fig. 1. A silent chain with the chain incased may be used, however, or a tight pulley may be supplied.

The principal dimensions are as follows: Height of drill to top of bonnet, 100 in.; distance of column to center of table, 11¼ in.; maximum distance from No. 4 taper spindle to regular table, 31 in.; maximum distance from spindle to base, 46½ in.; diameter of spindle nose, 2⅛ in.; vertical travel of spindle, 14 in.; vertical travel of table, 23 in.; size of regular table, 26x16 in.; floor space, 47x24 in., weight with coolant pump and motor drive, net, 2,700 pounds. A No. 5 Morse taper can be supplied for the spindle, if desired.

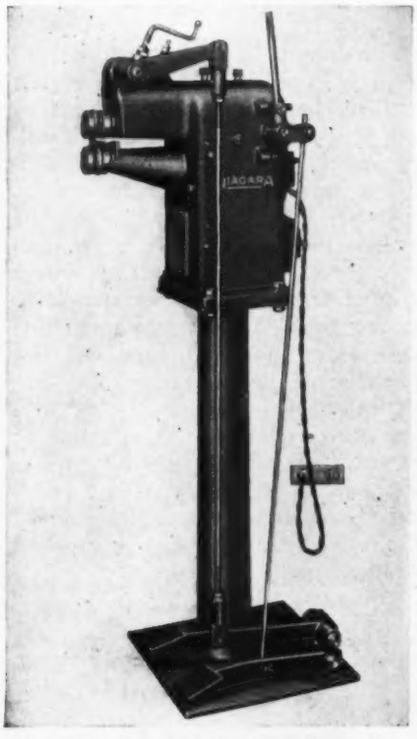
"Weldite" Type-T Welding Rod

An alloy welding rod for applying a highly wear-resistant surface by either the oxy-acetylene or metallic-arc welding processes, is being manufactured by the Fusion Welding Corporation, 103rd St. and Torrence Ave., Chicago, Ill. The manufacturers claim that the welding rod outwears the next hardest surfacing material by two to one, and also that the rod possesses ductility. It is used

to apply a hard surface on tools used for cutting metals, drilling rock, and for similar uses. It may also be used for putting cutting edges on lathes, shaper, and planer tools. The deposited metal has a Brinell hardness of approximately 600. The rod is obtainable in 100-lb. packages, wrapped five pounds to a bundle.

Niagara No. 172 Electric Combination Machine

A sheet-metal working machine that will handle up to 18-gage metal, and which is equipped with a built-in ¼-hp. motor operated from the ordinary lighting socket, is being manufactured by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. All of the general operations on sheet metal, such as burring, turning, wiring, crimping,



Niagara No. 172 Electric Combination Machine

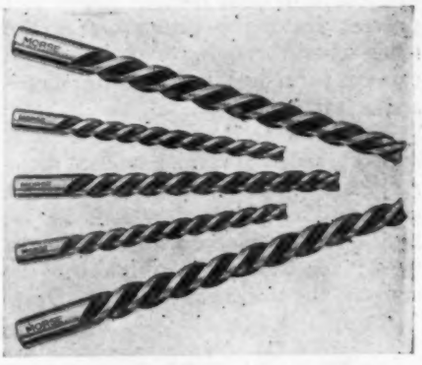
beading, slitting, flanging, and elbow edging can be performed on this machine. The frame of the machine is so designed that it houses the motor rigidly and encloses all gears and clutch parts. The clutch gives control either by hand lever or foot treadle, and can also be locked for continuous operation. A switch is mounted on the machine, and is provided with overload protection. The drive shaft and intermediate shafts are mounted on ball bearings, and the roll shafts are bronze bushed. Motion of the upper shaft is controlled by a combination crankscrew and foot treadle, either of which operates independently without removing or adjusting the other. Lateral adjustment of the upper shaft is accomplished through two knurled screws. The machine is mounted on a steel pedestal, arranged with two pedals for convenient operation of the clutch or upper shaft motion.

The machine is sold complete with steel pedestal, clutch, ¼-hp. a.c. motor, electric switch, cord and plug, wrench, foot treadle for shaft motion, foot treadle for clutch control. Standard rolls for burring, turning, wiring, beading, crimping and slitting are carried in stock, with suitable gages for each operation. Flanging, elbow edging, and special rolls for other operations on sheet metal are made to specification.

Morse No. 678 Diemakers' Reamers

The taper die reamer illustrated is designed especially for diemaker's use. It has been placed on the market by the Morse Twist Drill & Machine Company, New Bedford, Mass. The taper on the reamer is ¾-deg. included angle, approximately 0.013 in. per inch, as this is the angle of clearance considered best for die work. In laying out a die, holes can be drilled close together, outlining the shape desired, and then reamed with this tool until the holes run together and the central piece drops out. The reamer can then be run along the outline of the die edge as a spiral mill and the resulting clearance is correct for the finished die. This method is simple, easy, and fast, and the hand work is much less than by other methods.

Rapid action of the reamer and its freedom from chip clogging are two features. Another is its freedom from breakage, as the easy shearing cut imposes little strain upon the cutting edges. Large sizes of these reamers can often be used for profiling, as the action is that of a helical

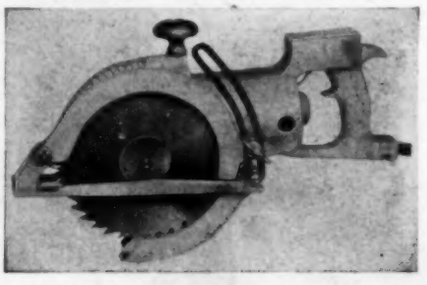


Morse No. 678 Diemakers' Reamers

mill. They are made in sizes from AAA to U and vary in diameter at the small end from 0.058 to 0.443 in. and at the large diameter from 0.073 to 0.518 inch.

Wodack Model "K" Electric Handsaw

A light-weight, one-hand electric saw is being placed on the market by the Wodack Electrical Tool Corporation, 4627 W. Huron Street, Chicago, Ill. The saw weighs but 15 lb. complete, and is of compact construction, featured by a sawdust blower to aid vision, a convenient trigger switch, a momentary contact, rip gage to save marking the board to be sawed, and a



Wodack Model "K" Electric Handsaw

depth gage adjusted by a wing nut. The unit is furnished complete ready to use. Accessories included are a 15 ft. extension cord, a 1 lb. can of lubricant, a grease gun, a steel carrying case, an adjustable depth gage, and a rip gage. The saw is designed to suit the needs of carpenters, engineers and contractors on a wide variety of work, and will saw boards up to 2⅜ in. in thickness. It is also used for crating in industrial shipping departments and for plant maintenance and repair work of various kinds.

Rockford Hydraulic Shaper-Planer

THE outstanding feature of this hydraulic shaper-planer is the fact that both table and feeds are operated by hydraulic power. This improved unit has been announced by the Rockford Machine Tool Company, Rockford, Ill. An Oilgear pump operates a hydraulic cylinder which is mounted in the bed close up under the table. The piston of this cylinder is directly connected to the table and exerts a maximum pull of 10,800 pounds. Any desired cutting speed up to 75 feet per minute is available instantly. Table reversals are smooth and shockless. Ratio of cutting speed to return is one to three.

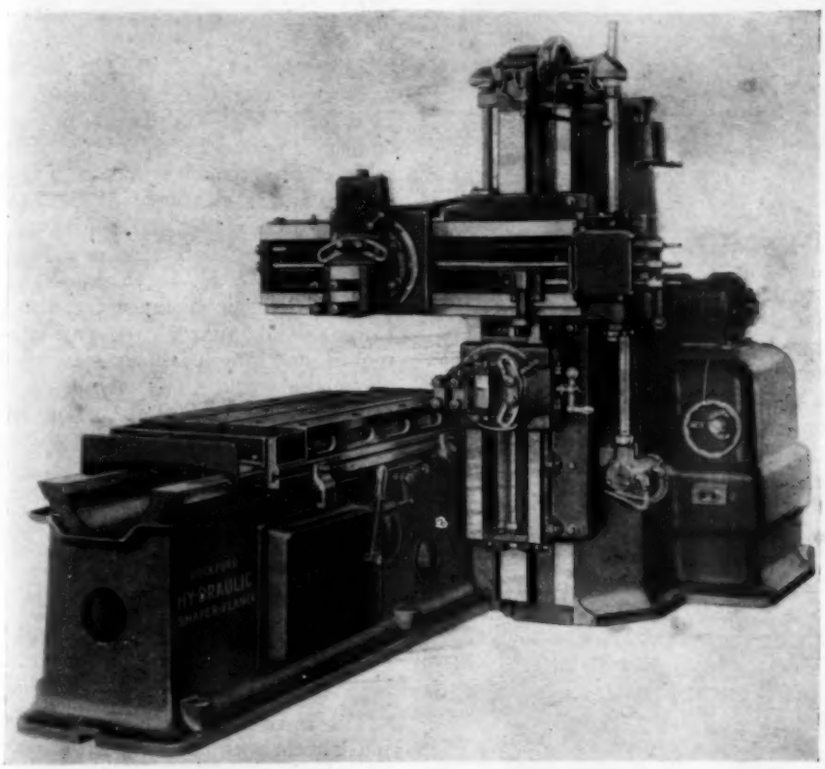


Fig. 1—Rockford Hydraulic Shaper-Planer

Some of the features of this machine, as compared to the shaper-planer brought out two years ago are: Increased work capacity; greater power, strength, and rigidity; fingertip convenience of control; exact adjustment of speeds and feeds to work requirements; speedier operation; higher table-return ratio; simplicity; longer life; accuracy easily maintained, and pressure lubrication of bearings by filtered oil.

Hydraulic power for the feeds is provided by a separate pump. There are 20 horizontal feeds ranging from 0.010 in. to 0.200 in. and an equal number of vertical feeds ranging from 0.004 in. to 0.080 in. Feed takes place after the table returns and before the cut starts.

The hydraulic table drive removes cross shafts and working parts from the interior of the bed, permitting it to be extra heavy in section to withstand the heaviest loads which may be imposed upon it. The ways are accurately scraped to gages and are lubricated by filtered oil under pressure.

The column is keyed and rigidly bolted to the bed. Of deep box-type construction and gibbed to wide flat-top V ways, the table has three machined T slots and four rows of reamed holes. The crossrail is L shaped with a long vertical bearing and narrow guide fitted and gibbed to the front face of the column. The side head and its rail are adjustably mounted on the front of this vertical section.

A sturdy box-section brace is dowelled and securely bolted to the crossrail and reaches back to the rear of the column where it bears, and may be clamped on an accurately machined surface. Both rail and side heads are of the graduated swiveling type provided with tapered gibs. The rail head has horizontal and vertical power feeds in both directions and rapid traverse to right or left. The side head has vertical power feed and hand horizontal feed. A small electric motor at the top of the column supplies power for raising and lowering the counterbalanced rail and for rapid-traversing the rail-head in either direction. Interlocking mechanisms, automatic trips, and shear pins protect the machine against damage. Centralized, sensitive, controls are a feature.

SPECIFICATIONS

Stroke of table, standard machine (42 in.)	43 in.
Stroke of table, 66-in. machine	67 in.
Stroke of table, 90-in. machine	91 in.
Length of table, 42-in. machine	54 in.
Length of table, 66-in. machine	78 in.
Length of table, 90-in. machine	102 in.
Width of table, all machines	24 in.
Three $\frac{1}{16}$-in. slots, center to center	7 in.
Four rows of holes in table	1 in. diam.
Maximum distance, table to cross rail	24 in.
Number of feeds, horizontal and vertical	20
Feed, horizontal	0.010 to 0.200 in.
Feed, vertical	0.004 to 0.080 in.
Length of saddle on cross rail	16 in.
Horizontal travel of tool	26 in.
Vertical travel of tool	7½ in.
Floor space standard machine (42 in.)	58½x119 in.
Maximum height	101 in.
Horsepower of motor	7½
Speed of motor	1,800 r.p.m.

SPECIFICATIONS OF SIDE HEAD

Maximum distance side head tool above table	18 in.
Horizontal travel of head tool	6 in.
Width of side head saddle	10½ in.
Length of side head saddle	12½ in.
Number of feeds vertical	20
Feed	0.010 to 0.200 in.
Weight of standard machine (42 in.) with side head, without motor	14,000 lb.

A housing at the rear of the machine incloses and protects the three pumps. A door equal in size to the housing provides ready access. The third pump forces filtered oil to the

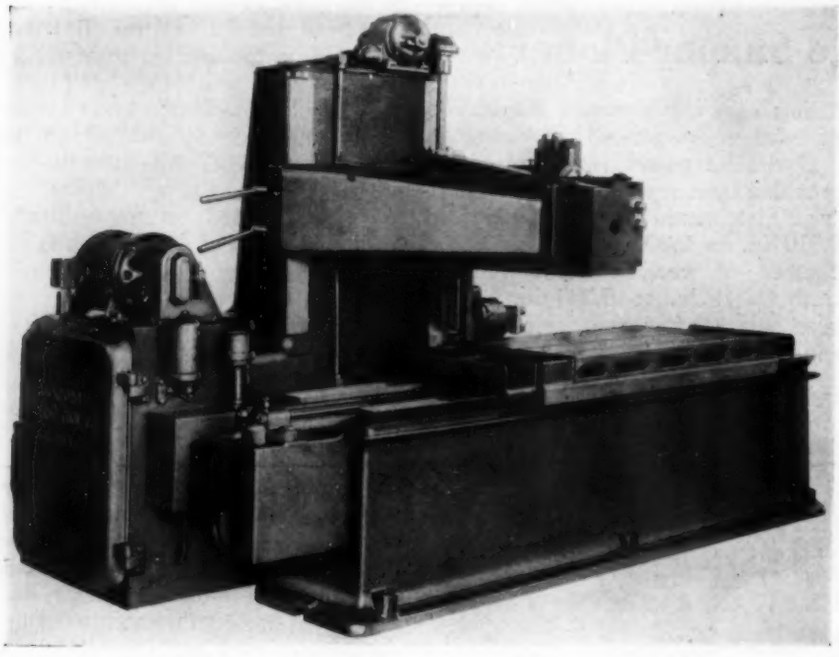


Fig. 2—View from the rear of the rail, showing the drive arrangements

ways, about the only bearings on the whole machine which require this type of lubrication because of the hydraulic drives.

By mounting a grinding head on the crossrail, a reversing cam on the table, and making two simple adjustments, this shaper-planer is converted quickly into an accurate surface grinder. Provision is made for the complete protection of all finished surfaces on the machine. The table speed, approximately the same in both directions, is correct for surface grinding and feed takes place at both ends of the stroke.

Extra equipment can be furnished for this machine as follows: Second rail head, side head, circular planing head, grinding head, two piece vise (stationary jaws), standard shaper vise, boom crane, shoe and wedge chuck, driving rod brass planing fixture, and index centers.

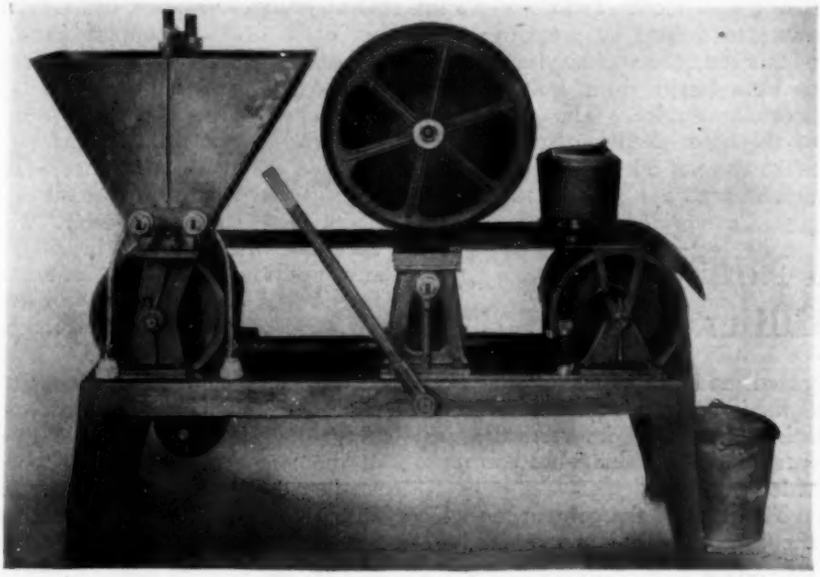
Horn Improved "Safety" Bandsaw

An improved safety bandsaw is being marketed by the Horn Device Manufacturing Co., Kenmore Box 784, Akron, Ohio. The machine incorporates the principles of design of former Horn saws, but includes many improvements. Striking features of the saw are a spring control tension element, Timken bearing equipment, and a spur gear and pinion drive. As may be seen from the illustration, the entire vertical movement of the top wheel is controlled by a spring. The operator cannot put more tension on the blade than that predetermined by the manufacturer. This feature of the design also makes for easy removal of the saw and prevents excessive or insufficient tension. The bottom wheel bearing of the saw is constructed of two Timken taper roller bearings packed in grease. Steel disk wheels with rubber, ground and crowned after assembly, are utilized for the running wheels for the saw blade, which is completely guarded except at the cutting point. Guards also cover the upper wheel, the lower wheel, and the motor, protecting the operator and also protecting the equipment from flying shavings, sawdust, and similar material. A spur pinion and gear drive is utilized for high-speed drive of the wheel directly from the motor. Guide plates 2½ in. long, made of hardened tool steel, are adjustable to hold the blade regardless of the amount the work may be turned. Hardened tool steel thrust wheels are located above and below the table, and are used to take up the thrust from the saw. The table of the machine is 18 in. square with the blade off center, thus giving 11 in. of table from the blade to right-hand side and to the rear edge of the table. The machine has a 13¾-in. throat, and a clearance of 5½ in. is allowed under the guide for wood. The maximum soft steel which can be sawed is ⅛ in. in thickness, and brass of 1 in. in thickness can also be sawed. All guards are easily removed, and a light is included directly above the work. The weight of the saw complete is 200 lb. The spur gear is cast iron, driven by a composition pinion on the motor. A ½-hp. motor, which can be operated from a 110 volt a.c. light socket, or a 220-volt power circuit, is provided.

Horn Improved Safety Band Saw

Scovil Polishing-Wheel Resurfacing Machine

For re-coating the faces of polishing wheels with accurate flat surfaces of abrasive grain in a manner which would secure maximum life and uniform polishing, the machine illustrated below has been developed by D & H Scovil, Inc., Higganum, Conn. Abrasive grain is heated electrically while in the hopper to approximately the glue temperature and discharged thence onto a conveyor belt in an even stream of the correct width for the wheel. In this way an even flat surface is produced in contrast to the rounded surfaces produced by rolling the wheel in a trough of abrasive material. The wheel is held between clamps which prevents the wheel from spreading during the operation, and is so mounted that the grinding surface is parallel to the



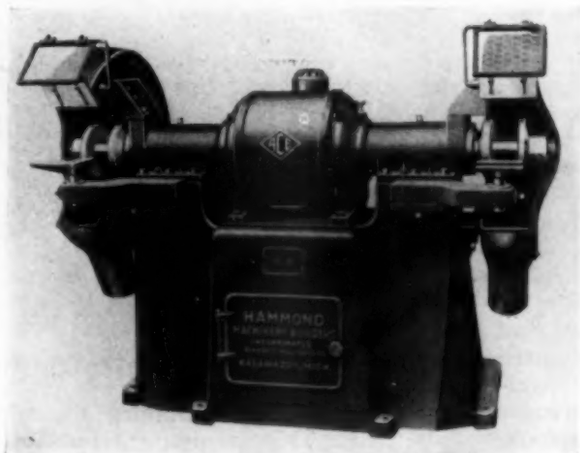
Scovil Polishing-Wheel Resurfacing Machine

axis of the wheel, thereby insuring even polishing when in use.

The machine is mounted on a sturdy cast-iron bed with the working plane at the correct height from the floor. The electrically heated hopper is provided with valves to shut off the abrasive, and it discharges upon an 8-in. steel belt which may be adjusted for tension at the opposite end of the machine. The wheel mounting is controlled by a lifting jack from a lever at the front of the machine to lift the wheel clear from the conveyor belt. A reduction drive is employed between the motor and the belt drive. The width of the abrasive stream placed on the belt may be controlled by means of a suitable valve.

Hammond Type WH "Ace" Heavy-Duty Electric Grinder

Rigid construction for heavy-duty work is found in the type WH "Ace" heavy-duty electric grinder manufactured by the Hammond Machinery Builders, Inc., formerly the Hill-Curtis Company, Kalamazoo, Mich. These grinders are equipped with totally-inclosed motors, patented air cleaner, four oversize ball bearings, mounted on an extra-heavy chrome-manganese steel spindle, an automatic motor starter having thermal overload protection and low voltage protection with push-button control conveniently mounted on the pedestal. Boiler-plate adjustable steel wheel guards of approved type, together with hinged doors, exhaust pipe connection, adjustable spark and chip breaker and eye shield, are features. The complete guard is adjustable to the wear of the grinding wheel, permitting maximum working space with protection to the operator. Grinding wheels are not supplied regularly, but can be furnished to order. Machines are available for 220-, 440-, and 55-volt, 2- or 3-phase, 25-, 40-, 50-, and 60-cycle a.c. circuits and 110-, 220-, and 550-volt d.c. circuits.



Hammond Type WH "Ace" Heavy-Duty Electric Grinder

Large oil reservoirs are provided with convenient oil cups, oil level gage and drain plug for ease in flushing the bearing chamber. The automatic motor starter with push-button control and overload protection is mounted on the inside of the pedestal door for convenience of inspection. The machine is made in 5-, 7½- and 10-hp. sizes.

"Dimondite" Tungsten-Carbide Cutting Metal

A tungsten-carbide metal known as "Dimondite" is being introduced by the Firth-Sterling Steel Company, McKeesport, Pa. The material is claimed to approach the diamond in hardness and high-speed steel in toughness, making it particularly useful in place of high-speed steel or commercial diamonds for the tips of edges of cutting tools. Dimondite is obtainable either as a tip on solid-shank tools or as a tip on standard and special toolbits.

"Niclad" Heat-Resisting Pot

A heat-resisting pot of ductile pressed steel, covered with a heavy layer of non-oxidizing metal, is being manufactured by the Flannery Manufacturing Co., Flannery Bldg., Pittsburgh, Pa. The manufacturer claims uninterrupted service for this container for indefinite periods of time and also claims practical immunity to the action of cyanide, salt, and caustic baths. The inside of these pots consists of a low-carbon steel or ingot iron form-drawn from a solid sheet, while the outside is built up of nickel or some other heat-enduring metal or alloy, progressively deposited by the electric arc over the entire surface so as to protect it against oxidation at high temperatures. The inside of the pot, which comes in contact with salt mixtures, cyanide, or lead, as the case may be, consists of practically pure iron in dense-drawn form

capable of resisting the chemical and metallurgical action of the bath, while the outside, due to its layer of non-oxidizing metal, resists the action of air and combustion gases at high temperatures. The pots are claimed to have high thermal conductivity and are also claimed to be strong, tough, and ductile, and therefore immune to failure by cracking. Pots of this construction have been claimed to have lasted from 4,000 to 7,000 hours in service. The construction of the outer shell is also claimed to make the pot adapted to the absorption of heat.

Oesterlein No. 36 "Mil-O-Matic" Milling Machine

AUTOMATIC hydraulic operation is the feature of the No. 36 "Mil-O-Matic" bed-type milling machine placed on the market by the Oesterlein Machine Company, Cincinnati, Ohio. The machine may be equipped with either a plain reciprocating table having a 21 x 48-in. working surface, affording a feed of 36 inches, or with an automatic indexing table of 14 x 24-in. working surface, mounted on a slide that has a 24-in. feed. On the indexing-type machine, the table makes a half turn at the end of its return stroke and then advances again to the cut. The machine is available in single-spindle, duplex, vertical, and multiple-spindle models, each in several standard bed lengths and table lengths. Special heads may be applied, depending on requirements. Normal range of the spindle speeds is from 20 to 242 r.p.m., and the feeds range from 0 to 30 in. per minute.

The spindle head is an entirely self-contained unit. It carries its own motor; starting, stopping and reversing mechanism and control lever; pickoff gears for determining speed; and all adjustable controls. Being self-contained, it can be mounted at any angle or in any position to suit special requirements.

The gears within the spindle head are all made of alloy steel, heat-treated, multiple-splined, and inclosed in grease-tight cases. Anti-friction bearings are used throughout the drive, including the spindle which runs in two 12½-in. and two 5½-in. Timken bearings. Spindle is made of chrome-nickel steel, heat-treated, and has the standardized nose.

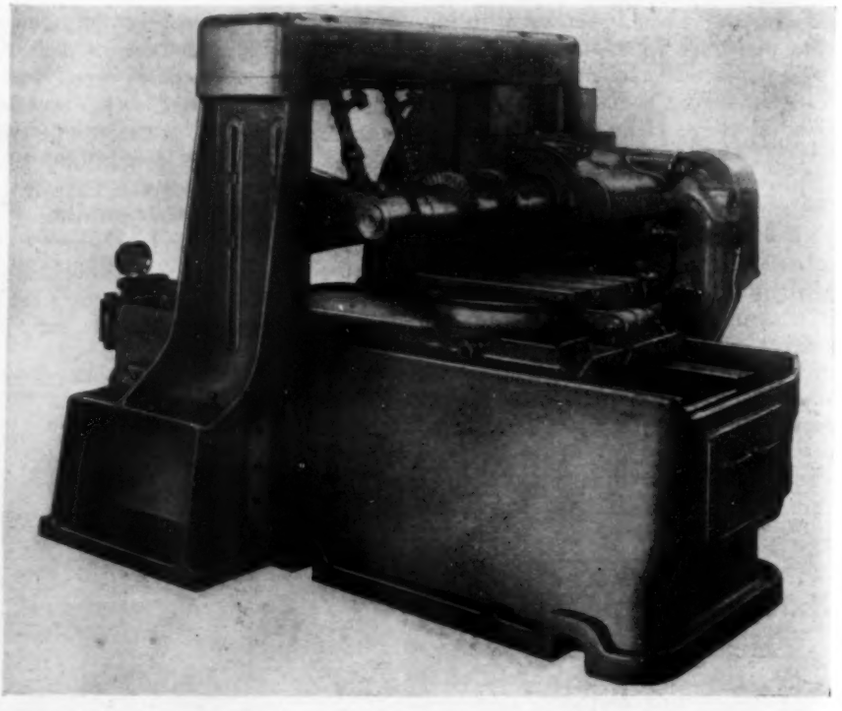
By pulling the starting lever forward, the spindle runs right-handed, while pushing it backward causes it to run in the reverse direction. In the neutral position, power is disengaged and the spindle stops. An 8 in. in-and-out adjustment for the spindle and a 14 in. vertical adjustment for the spindle-head are provided in the design.

The base of the column, on which the spindle-head is mounted, has a compartment into which is mounted a direct-connected, motor-driven Oil-gear unit for furnishing the table feed. This arrangement leaves the entire bed reasonably clear of mechanism and available for chips and coolant. The column is keyed and bolted to the bed. A heavy tie piece interlocks it to the outboard bearing support, giving the effect of planer construction and affording a very rigid support for the arbor. For lighter jobs, or on duplex machines, when unnecessary, the tie piece and outboard bearing support may be omitted and and overarm mounted on the spindle-head instead.

The bed and table have ways made of hardened and ground steel strips, doweled and bolted in place. They are so located as to support the entire width and length of table, which does not overrun the bearings in any position. Constant, automatic, forced-feed lubrication is provided for these bearings when the machine is running.

The indexing table is mounted in a pair of radial ball bearings. The heavy-duty upper bearing is 8½ in. in diameter, and the lower one, a smaller double-race bearing, affords an outboard support for the indexing pinion. When indexed, a hardened and ground locating plunger, mounted and engaged in hardened steel sleeves, locates the table in alignment with the spindle at the extreme edge of table bearing, and a taper split ring binds it to the slide around its entire periphery. The indexing mechanism and ball bearings are contained in a grease-tight case filled with lubricant.

When the parts to be milled are clamped in place, and the machine is ready to run, the operator merely pushes the lever which starts the



Oesterlein No. 36 "Mil-O-Matic" Milling Machine

quick advance. From this point, the machine operates automatically, and the operator's only duty is to remove finished work and reload the fixtures. From quick advance, the table movement slows down to the feeding rate for which it is set. At the end of the cut, the quick return is engaged automatically and brings the table back to starting position at the rate of 180 in. per minute. In transit, when near the end of its return stroke, a Geneva mechanism unlocks the index table, returns the ratchet and withdraws the table locating plunger. At the extreme end of the return stroke, where this cycle of operations is complete, if set to repeat, the forward quick travel begins again, and in the first 2½ in. of forward motion indexes the table automatically by means of the ratchet. Upon leaving the Geneva rack, the indexing mechanism, being disengaged, ceases to function. The inertia of the revolving table carries it forward until a spring sets the plunger for locating the table radially. When this plunger moves into place, it releases the interference to the clamping ring locking device, thereby permitting the clamp ring to lock the table. For accomplishing this smoothly, a slight hesitation is affected in the forward motion of the slide, after which the quick advance continues to the cut. The feed rate is then re-engaged.

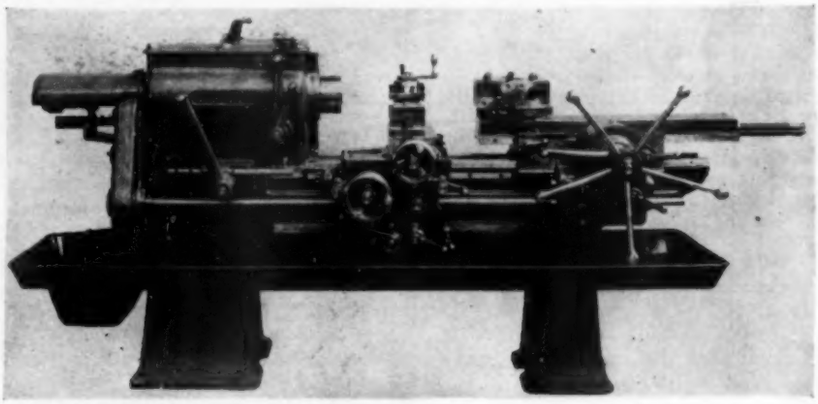
In connection with Oilgear equipment, as applied to the Mil-O-Matic, a cam plate is used for operating the lever that controls the pumping mechanism and governs the rate and direction of motion of the table. Either a constant, varying, or intermittent feed is available, depending only on the contour of the cam in use. A roller, mounted in a pair of radial ball bearings, rides on the cam face and positions the control lever. At the end of the cut, before the roller cam drops off the cam plate and engages the return, its periphery must clear the plate. This results automatically in a gradual reduction in the rate of feed to practically a pause in the bottom of the cut. This is never objectionable, but on the contrary, in a great many instances where a plunge cut is used, it gives the desired feed reduction in the bottom of the cut automatically. It furthermore insures accurate reversing when at the desired depth of cut.

In the neutral position of the control lever, the table is stationary. Under ordinary operating conditions, springs operate a "load and fire" device and keep the control lever on one side or other of neutral. The table therefore continues to reciprocate and index automatically. However, an interference device is provided. When set to interpose the repeat, it stops the table at the end of its travel at its greatest distance from the cutter. Under no circumstances, can the table be indexed at any other position. In this position, as noted above, the index lock plunger is withdrawn and the turret clamps are released. The table may then be indexed by hand for the purpose of inspecting the work. Another advantage of the interference device is in the fact that it insures the necessary safety in cases where an operator is looking after more than one machine, or when the loading time exceeds the cutting time, by stopping the table at the end of each return stroke.

The machine is equipped with an individual motor-driven coolant pump with capacity to deliver 40 gallons of coolant per minute to the cutters. Suitable guards are provided for retaining the coolant within the confines of the machine. A 10-hp., 1,740 r.p.m. motor is required to drive each standard spindle. A 5-hp., 1,200 r.p.m. motor is required for driving the Oilgear unit, and a ½-hp. built-in motor, is provided with the pump. The complete single spindle machine, when furnished with tie piece and outer arbor support, weighs approximately 14,000 pounds net.

Gisholt No. 4 Universal Turret Lathe

PROVIDED with a turret that is clamped and unclamped automatically, thereby saving operating effort and maintaining accuracy, the No. 4 universal turret lathe has been announced by the Gisholt Machine Company, Madison, Wis. A bevel clamp ring, operated by an eccentric toggle is opened and closed about the base of the turret by the backward and forward movement of the turret slide, and, because it is operated by an eccentric toggle, the radius of whose cam approaches infinity as the closing occurs, no extra effort in moving the slide is needed. By the use of this construction the ill effects arising out of the operator's failure to tighten fully the ordinary hand clamp after indexing, such as weaving of the turret under the cut, damage to the bearings, and elongation of the locating bushings, are done away with. The entire strain of the cut is taken by the clamp ring. No strain is permitted on the locating bushings. A protected, positive gib lock keeps the turret slide in exact alignment. The turret stop roll permits adjustment to 0.002 in. between the automatic feed trip and dead stop. Close adjustment between the automatic feed trip and dead stop permit close facing and shoulder tolerances.



Gisholt No. 4 Universal Turret Lathe

Another feature is that a single

lever controls the starting, stopping, and reversing of the spindle through a multiple-disk clutch and brake. Twelve spindle speeds, 28 to 751 r.p.m., are obtained selectively through sliding gears and a positive jaw clutch. A brake is applied automatically at the neutral position of the control lever and a special safety latch prevents starting the spindle accidentally. Hardened alloy steel headstock gears mounted on splined shafts and tapered roller bearings on the spindle and the drive shafts are other features. Lubrication of all bearings and gears in the headstock is by means of centrifugal lubrication. The speed change levers seat firmly and positively in position. Drive is taken from a motor mounted behind the headstock leg, through Texrope belts to a balanced driving pulley on the headstock, thus assuring smoothness in operation of the machine. It is claimed that the speed rating may be doubled without damage to the bearings or clutches.

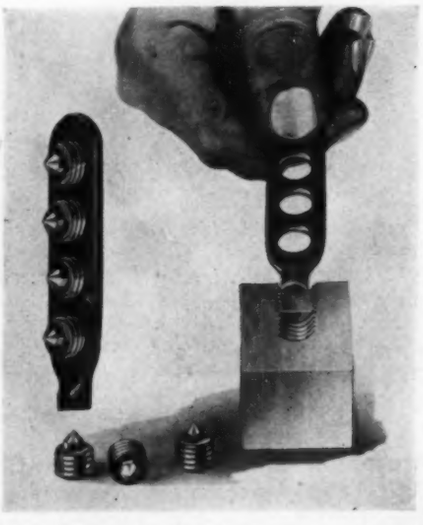
SPECIFICATIONS

Automatic chuck capacity for round stock	2 in.
For hexagon stock	1⅜ in.
For square stock	1 7/16 in.
Hole through automatic chuck tube	2 1/16 in.
Hole in spindle	2 7/16 in.
Swing over ways	19¾ in.
Swing over cross-slide wings	17¾ in.
Swing over cross-slide	10¼ in.
Diameter of three- or four-jaw chuck	10 or 12 in.
Maximum distance from face of turret to end of spindle nose	31 in.
Longitudinal travel of hexagon turret	14 in.
Swing over turret slide	7⅜ in.
Longitudinal travel of cross-slide	26 in.
Cross travel of cross-slide	10⅞ in.
Center of turret holes to top of ways	9½ in.
Diameter of turret holes	1¾ in.
Width of turret across flats	10¼ in.
Width of square turret toolpost	5 in.
Horsepower motor	3 hp.
Speed of motor	1,200 r.p.m.
Floor space	40 x 99 in.
Length of bar feed beyond pan	38 in.
Net weight	3,450 lb.

A square turret is mounted on the front of the bridge-type cross-slide. It indexes automatically with the release of a clamping lever allowing the operator to use his right hand for indexing and clamping while his left hand positions the carriage for the next cut. The front wings of the carriage pass by the throat of the bed. An auxiliary toolholder may be mounted on the rear of the cross-slide for cutting off or for use with a taper attachment. The carriage moves on hardened steel ways with apron bearings at the bottom of the bed. Eight selective speeds in the apron range from 0.002 in. to 0.067 in. The apron parts as well as those in the turred apron run in oil. A hand pump is located below the cross-slide apron for lubricating the bed ways, cross-slide and cross-feed screw.

National "Make-Shur" Thread Button Set

A device for locating holes for body screws in a plate which is to be secured to a piece in which the threaded holes do not extend all the way through, is being manufactured by the National Machine Tool Company, Racine, Wis. The manufacturers claim that a layout for this sort of hole is not needed when the set they manufacture is used. The device incorporates four thread center punches held in a combination holder and socket wrench. In operation, the center punches are screwed into the tapped hole, point outward, by means of a hexagon head on the screw which fits the holder. The piece may then be placed, and a hammer tap will locate the center of the hole which must be drilled accurately. All punches used are ground from the thread and the sets are manufactured in various sizes.



National "Make-Shur" Thread Button Set

TRADE PUBLICATIONS

CONVEYOR EQUIPMENT. The Saginaw Stamping & Tool Co., Saginaw, Mich., has published catalog No. 29-CE, 1930 edition, which is a revision of the 1928 catalog. The illustrations cover the complete line which has been fully standardized and filled out to suit various requirements. An introduction gives an analysis of conveyor problems and gives points which will enable the selection of proper material to suit given requirements. The catalog contains 42, illustrated, 11x8½-in. pages which are bound attractively.

CUTTING TOOLS AND TOOLHOLDERS. The Gairing Tool Co., Detroit, Mich., has published catalog No. 20, which is a very handsome catalog of its standard and special cutting tools and toolholders. The catalog is replete with illustrations of the various products and gives complete descriptions of each. Many color plates are included showing the uses of these tools on certain jobs. Tables of sizes and various engineering data are included. The book contains 124, 8½x11-in. pages in an artcraft binding.

MILLING MACHINES, FOR AIRCRAFT MANUFACTURING. The Kearney & Trecker Corporation, Milwaukee, Wis., has published a booklet entitled "Milling Faster for an Industry that Flies," which presents pictorially the various types of aeronautical work which can be performed on milling machines and gives the problems of each job and how they are met. The book is replete with illustrations of various aeronautical parts and machine set-ups. It contains 23, 11x8½-in. pages.

WELDING AND CUTTING EQUIPMENT. The Torchweld Equipment Co., 224 No. Carpenter St., Chicago, Ill., has published catalog No. 29 on welding equipment, cutting equipment, cutting units, cutting units and torches, regulators, and piece parts. It illustrates and describes the constructional features of each type of apparatus and gives available sizes. The catalog contains 39, 11x8½-in. pages.

WOOD-WORKING MACHINES. The Mattison Machine Works, Rockford, Ill., has published a bulletin on its No. 205 jointer-edger-ripper machine, giving the constructional features both pictorially and by text matter, together with various set-ups for production operations in wood-working plants and work in pattern shops. The specifications are listed. The catalog contains eight 11x8½-in. pages.

NEWS
OF THE WEEK

A.S.M.E. Fiftieth Anniversary To Be Observed Next Year

OUTSTANDING engineers of the world will meet from April 5 to 9, 1930, in New York, Hoboken, and Washington to celebrate the fiftieth anniversary of the founding of the A.S.M.E. The exercises will be non-technical in nature and will stress the humanistic side of engineering. They will be pre-eminently an exchange of greetings between nations through the medium of a series of papers presented by prominent engineers from each of sixteen countries, or geographical divisions of the world. These papers will develop the theme of what engineering has done for each author's country in a national sense as well as for the advancement of world culture and civilization. The engineers will also endeavor to forecast the lines along which engineering may be expected to develop in the future, and inform the convocation of some of the great engineering problems confronting their respective nations.

The program will be carried out in three parts. At New York, on April 5, the delegates will be conducted to the McGraw-Hill Publishing Co., and will be entertained in the offices of the *American Machinist*. This portion of the program will commemorate the preliminary meeting of organization of the A.S.M.E., held on February 16, 1880. The second portion of the program will be held at Stevens Institute, Hoboken, N. J., where the organization meeting of the Society was held on April 7, 1880. The third part of the program, in which each of sixteen of the world's distinguished engineers will present a summary of his paper, will be held in Washington on April 7 and 8. The Founders' Luncheon will also take place in Washington on April 8, as well as an award session immediately afterward.

The A.S.M.E. is one of the two great national engineering bodies in whose formation the *American Machinist* has played a prominent part. The other is the Army Ordnance Association. Three years after the founding of the paper, the idea of a national society of mechanical engineers was conceived, and the first meeting of the proponents was held in the offices of *American Machinist*. That meeting would have ended in disagreement had not the publisher, Horace B. Miller, invited the conferees to be his guests at dinner at the old Astor House. His geniality saved the day. Lewis F. Lyne, Sr., then mechanical engineer of the staff of *American Machinist*, had a large share in the drawing up of the Society constitution.

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Autumn Sales Outlook is Good But Automotive Production Drops Off

By Robert M. Davis
Statistical Editor, McGraw-Hill Publishing Company

CURRENT business volume in the metal-working industry, as a whole, is on a materially higher plane than at the opening of September, or at the opening of October last year, according to opinions on business conditions expressed by members of The Council on the Trend of Business, an organization conducted by *The Business Week*. The opinions of the 5,600 executives composing the Council, of whom about 975 are directly interested in the manufacture and distribution of metal products, reflect actual business conditions in that their opinions are based upon the basic factors of unfilled orders on hand, inquiries by buyers, current sales, and collections. These men state that their volume of business at the opening of October was about 3 per cent greater than on the first of September, and about 6 per cent greater than on the first of October last year.

The volume of business at the opening of October in the automobile industry, including the manufacture of cars, parts, and accessories, as well as the distribution of cars, was on a plane about 2 per cent under that at the opening of September, and of about the same proportions as that at the opening of October last year. The volume of business in other branches of the metal-working industry was about 4 per cent more than that at the opening of September, and 8 per cent more than at the opening of October last year.

Those Council members in the metal-working industry express the opinion that the general outlook for the next three months is very good. The automobile industry as a whole expects to do a volume of business during the last quarter of the year about 5 per cent greater than that at the opening of October, but of about the same proportion as that during the last quarter of 1928. The other branches of the metal-working industry expect to do a volume of business during the next 90 days about 6 per cent greater than that at the opening of October, and a volume which will exceed that during the same 90-day period last year by 7 per cent.

The favorable outlook in the agricultural industry continues to dominate the economic horizon, in the opinion of the members of the Council. Agricultural conditions are more spotted than earlier in the fall, owing to uncertainty of weather conditions, and to the invasion of insects, especially in the cotton fields, but general prices of farm products continue good with a resultant increased return to the farmer which should compensate for the decreased crops reported from some sections. Other favorable factors on the general business horizon are: a confidence and optimism existent among business men; small inventories and volume turnover on the part of the distributor; and the systematic curtailment of production on the part of the manufacturer to meet the demand—that is, balanced supply and demand; a fair demand of constant proportions for commodities—a reflection of the continued high purchasing power of the consumer; and a generally high volume of construction, notwithstanding the curtailment of residential construction.

But every rose bush has its thorns and there are some rather irritating thorns on the bush of current economic conditions. There is no doubt but that the business men throughout the country are becoming alarmed over the continued speculation in the stock market with its attendent money stringency. In the opinion of the members of The Council, speculation and high money rates constitute a very serious danger to the immediate future of American business.

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S.A.E. Nominates Remaining Officers

In addition to Edward P. Warner, editor of *Aviation*, a McGraw-Hill publication, who was nominated last summer for president of the S.A.E., the nominees for vice-presidents and counselors have been announced by the respective nominating committees of the divisions. Chance M. Vought is the

vice-presidential nominee for aircraft engineering. Booth G. Leighton is nominee for aircraft-engine engineering; O. D. Traiber for Diesel engine engineering; Arthur J. Scaife for motor-truck and motor coach engineering; John McKane for passenger-car engineering; William N. Davis for passenger-car body engineering; John Younger for production engineering, and Frederick C. Horner for transportation and maintenance engineering. Ralph Tettor, Frederick K. Glynn, and Arthur W. S. Herrington were nominated for counselors, and Charles B. Whittlesey, Jr., for treasurer. Nomination for these officers practically assures election, since only one person is named for each office.

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Show Visitors Include 53 Russian Engineers

Among the visitors at the Second National Machine Tool Builders' Exposition in Cleveland two weeks ago were 53 Soviet engineers and industrial executives who came here to study the newest American machine tools and methods of production. Their purpose was to select proper equipment for the new plant now under construction in Soviet Russia. The work of designing these first large machine-building plants in Russia, especially the two tractor plants in Stalingrad and Leningrad, an auto-truck plant, Amo, in Moscow, an automobile plant in Nijni-Novgorod, an agricultural machinery plant, Selmachstroy, in Rostov, has been to a considerable degree shifted to the United States. During the Exposition, the Soviet engineers, with the assistance of Amtorg engineers and representatives of various American machine-tool builders, went over their specifications and drawings and made final decisions on purchases of equipment. During their short stay in Cleveland, the representatives reached agreements with 28 American firms to place orders amounting to approximately $1,200,000.

* * *

Curtiss-Wright Announces Appointments

C. M. Keys, president of the Curtiss-Wright Corporation, announced recently the additions to the executive staff of the merged company. The new officers of the Curtiss Flying Service, which is henceforth to be known as Curtiss-Wright Flying Service, are: vice-presidents, J. A. B. Smith, former secretary and treasurer of the Curtiss Airplane and Motor Co., and Walter H. Beech, president of the Travel Air Co.; treasurer, J. F. Prince, treasurer of the Wright Aeronautical Corporation. Mr. Beech also will be president of the new sales company to handle sales of the commercial airplane products of the constituent companies. Charles L. Lawrence, president of the Wright company and vice-president of the merged companies, is the head of the technical committee of Curtiss-Wright Corporation.

Pneumatic Portable Tool Exports Show Increase

Foreign demand for American portable tools has been steadily expanding during the past few years, according to L. J. Cochrane, of the Industrial Machinery Division, U. S. Department of Commerce. In 1928, sales abroad reached a volume of more than $1,700,000. This represents a substantial increase over exports of the previous year and exceeds exports made in 1926 by 33 per cent and in 1925 by 47 per cent. The upward tendency has continued so far during 1929, returns for the first seven months of this year showing sales of nearly $1,240,000, as against sales of approximately $920,000 during the same period last year. The best markets narrow down to a relatively limited group of well-developed industrial or mining areas according to the report. American pneumatic portable tools are now being used all over the world, and in 1928, shipments, large and small, went to over 60 countries.

* * *

PRODUCTION from the automobile parts and supplies industry in Canada during 1928 was valued at $17,007,157, according to a statement just issued by the Dominion Bureau of Statistics. This was the highest value reported for the industry since the record of $22,000,040 was established in 1923.

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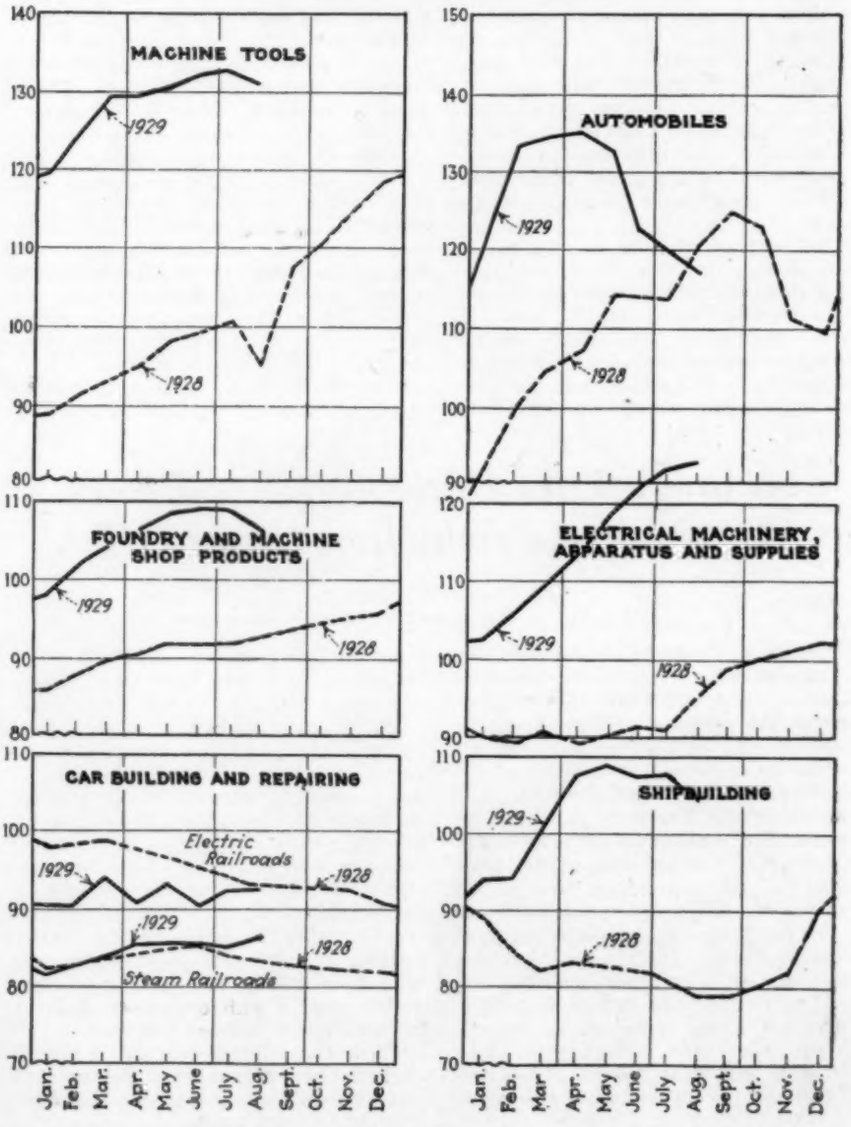
Trend of Employment in the Metal-Working Industries

Data Supplied by the Bureau of Labor Statistics

Monthly average for 1926 = 100



German Industrial Situation Gloomy Because of Lack of Capital

By Our Berlin Correspondent

FOR months German industry, viewing the business situation, has been facing a riddle which has been apparently defying the analysis of even the most astute observers. It has always been a recognized and unfailing maxim that a strong demand for coal and a prosperous "heavy" industry (as the iron and steel industry with its closer ramifications is called in Germany) herald a general upward movement. This time, it seems, there is something amiss with the business barometer. The coal market is exceptionally lively and the steel magnates of the Ruhr have every reason to be satisfied. Still the wave of prosperity which the super-ordinated industries, particularly machine building, have been awaiting for quite a while, is not coming. The singular fact can be noted that basic products enjoy a remarkably active business, whereas, in the refining stages, complaints of insufficient employment are the order of the day.

The bulletins on current business, which the Society of Machine Builders is now issuing monthly, all run in the same strain: Business not bad, but far from good, especially the domestic business, while export retains a fair average. This applies to all branches of the industry. Nowhere can an outstanding feature be seen or a quicker pulsation of the economic cycle indicative of an early improvement. Even strong optimism cannot perceive in the situation anything but stagnation, rather leaning to weakness than otherwise.

Machine-tool Industry Unsatisfied

The machine-tool industry, a recognized pace-maker, is satisfied with inquiries coming in, but not with the percentage of actual orders. Important sections of their market are decidedly inactive, especially the motor car and textile-machinery industries. "Rationalisierung," or economic production, which is the watchword of the day, has supplied a strong propelling force for a time, but is not making the same strides that it did one or two years ago. The truth seems to be that the leaders have completed their schedule of intended reorganizations and the general run is slow in following and is, perhaps, unable to do so. Preliminaries can be seen everywhere, but many of them get "hung up." The final push seems to be missing.

One has not to look very far for the reason. It is lack of capital, crippling enterprise in all stages of the manufacturing and the marketing process. Besides, the purchasing power of the population has clearly decreased. German industry is still expanding and needing more capital than it earns. Money is tied up in new investments as quick as it accrues, without satisfying actual requirements, and many such fresh investments, being incomplete, are debarred from bearing fruit at present.

The present German business problem is, therefore, one of the money market. It appears quite feasible that, in the course of time, the prosperity of the basic industries communicates itself to the higher stages. Perhaps it is slower than the theorists figured out, but a general rise can hardly be expected before an influx of fresh capital takes place.

* * *

Machinery Manufacturers Increase Earnings

An increase of 43.09 per cent in the average profits of twenty-nine manufacturers of machinery and equipment during the first half of 1929 as compared with the same period last year is shown in a tabulation by Ernst & Ernst, accountants.

The table follows:

	Net Profits 1929	Six Months to June 30, 1928
Allis-Chalmers Mfg.	$2,179,088	$1,480,007
American Brown Boveri	692,204	*238,606
Am. Machine & Fdry.	1,076,686	486,299
Briggs & Stratton	812,966	338,898
Bucyrus-Erie	1,505,262	1,401,000
Chicago Pneumatic Tool	713,610	371,485
City Machine & Tool	352,475	289,359
Doehler Die Casting	561,237	431,204
Emson Derrick & Equip.	862,898	350,021
Evans Auto Loading	554,562	491,536
Fairbanks Co	167,374	30,133
Fairbanks, Morse & Co.	1,121,826	1,004,408
Foote-Burt Co	241,711	320,631
Gardner-Denver Co.	689,687	398,094
General Electric	32,028,154	25,675,307
Hoe & Co	202,649	*187,308
Industrial Brownhoist	186,027	82,890
International Cig. Mach.	830,603	528,587
Intertype Corp.	413,476	268,021
Link Belt Co.	1,385,932	1,305,305
Marion Steam Shovel	300,788	379,017
National Acme	1,520,419	391,103
National Supply	1,637,315	738,700
Oil Well Supply	331,988	*85,936
Pantex Pressing Mach.	171,499	123,027
Seagrave Corp.	128,601	145,166
Sullivan Machinery	†463,223	348,215
U. S. Hoffman Mach.	418,398	477,543
Westinghouse Electric	13,131,881	7,860,755
	$64,682,539	$45,204,861

Percentage increase, 43.09.

Note—Where figures published are before certain charges they have been so included here. *Deficit †Estimated.

* * *

Unfair Practices To Be Discussed

Elimination of unfair practices in industry will be taken up at three conferences planned for the near future by the Federal Trade Commission. The cold-finished steel bar, the belting and sole leather, and the hardware jobbing industries are those affected by the conferences, which have as their object discussion of several topics, including: Interference with contractual relations, failure to maintain validity of contracts, price discrimination, protection against decline or advance in price, premiums, secret rebates, misrepresentation, defamation, and similar practices. When approved by the Commission, rules adopted by the industry, condemning such practices, are subject to enforcement under the Commission's ordinary procedure requiring offenders to cease and desist.

* * *

American Exports to France Greatest. Imports Lowest

By Our Paris Correspondent

Figures for the first six months of 1929 referring to French imports and exports show astonishing increases in special lines, indicating that the activity of the industries producing and distributing such is rgeater than ever before. It may be taken for granted that the United States, Germany, and Great Britain supply the bulk of volume and value in machinery and tools, the values in most cases being to the credit of America by reason of the export of a more costly product.

The figures given in detail cover six months, but the less explicit global figures for imports in July show that "materials for industry" were valued at 13,644,000 francs less than in July, 1928, while exports of "manufactured articles" likewise dropped 219,516,000 francs.

Exports were lowest to the United States and imports were greatest from the United States. Imports from Germany, however, made a greater gain than those from the United States. This was brought about by the German payments in kind on the reparations account, of which no inconsiderable proportion was machinery and tools and various fabricated metals for general use.

Actually, German exports of machinery, tools, and fabricated metals to France in 1928 were valued at 225,000,000 francs, which was a 250 per cent increase over figures applying to the same items the year before. American exports to France of like goods at the same time increased but 72 per cent. The showing of the latter might be considered satisfactory enough but for the unassailable competition of these German reparation exchanges. The total value of machinery and tools imported from Germany in that year increased 68 per cent, other machinery not specified, 52 per cent, the remainder of the percentage being made up of other metal goods.

Imports in all cases are more than double those of 1928. Exports of agricultural machinery and tractors largely exceeded imports, but the reverse was the case with sewing machines, due principally to the import of the low-priced, popular article from Germany. Pumps and air compressors show steadily increasing imports, though exports also show gains. Imports of automobiles have greatly increased, in fact more than doubled, the United States and Italy being the most important factors. Exports have barely held their own.

BUSINESS BAROMETER

Conferences Between President Hoover and Premier MacDonald Considered Most Important Events Since the Armistice

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

THE conferences between President Hoover and Premier MacDonald held in Washington last week have a significance that makes them the transcendent features of the week's news. In fact, they are probably the most important happenings that have occurred since the signing of the Armistice.

With the eye of the trained engineer, Herbert Hoover seems to have visualized a world in which the wastes of war may be avoided and the cost of preparing for it saved. Concurrently, the intellectual socialism of Ramsay MacDonald appears to have inspired him with a similar vision, and the hope of an era in which there will be no lost motion or destructive activity because everyone will be profitably and productively employed. The salient features of the picture that the President and the Premier saw were economic efficiency, aided by Anglo-American harmony; and while each man looked through his own glasses, both appear to have described a millennial view of the possibilities. It is probably too much to hope that the spiritual level to which politics and statesmanship have been lifted on both sides of the Atlantic will prove to be permanent. Were any such hope warranted, the greatest commercial and industrial boom in all history would probably follow, for it is almost impossible for the human mind to appreciate what a world that was constantly, happily, and universally employed could accomplish. The mere suggestion of such a consummation is inspiring, and ought to have a tonic effect upon business and enterprise everywhere.

In Europe, its effect is already noticeable. British trade is on the mend, despite the high bank rate. France is very prosperous; Germany is giving an inspiring example of how the busy bee improves each shining hour, and by exercise she is recovering her economic strength with amazing rapidity. Even Russia reports an improvement in her industrial position, and if the Soviet Government is recognized by Great Britain, the result will probably be a substantial increase in the trade between the two countries. Belgium is sharing in the prosperity which is coming to France, and Italy, Spain, Holland, and Scandinavia are all more prosperous than they have been since the war supplied them with an artificial trade tonic. Therefore, it is quite possible that the next great revival in business activity may be staged in Europe, where the future has not been as extensively discounted as in this country.

There are, however, few signs of a reaction to be found outside of the security markets, and business in America is generally good except in lines that are directly dependant upon the money markets. Hence, new construction that must be paid for by the sale of bonds or other evidences of capital expenditure has been somewhat restricted. Contracts awarded during September, the F. W. Dodge Corporation reports, totaled 24 per cent less than those of a year ago, and the ten months' total is 10 per cent less than it was in the corresponding period of 1928. But this decline is not causing much concern, and the bond houses are preparing for a quick revival in their business just as soon as the money market is permanently lower.

Whether or when the expected decline will occur remains to be seen. There are those who say that the Federal Reserve authorities have been instructed to prevent a further advance in interest rates Such reports are, of course, apocryphal, but it is possible that some of the President's advisers may have expressed themselves as believing that high rates for money during the crop-moving period would be a serious political mistake.

For the present, commercial money rates seem to be stabilized. The Reserve Banks are releasing enough credit to meet seasonal demands, but no more, and they have their position so nicely adjusted that no change is to be anticipated until after the holidays, if then.

But the chief encouragement of the stock market has been derived from the upturn in the unfilled orders of the U. S. Steel Corporation for September and the high rate of production that a few of the larger steel compânies maintain. The sheet makers, who sell principally to automobile companies, have reduced their output and many observers think fewer motor cars will be turned out during the remainder of the year than during the same period of 1928.

The commodity markets have been relatively quiet. Cotton declined on the government estimate that was slightly larger than anticipated, but it recovered part of the decline on the reports of good trade in this country and abroad that followed the "Bureau Report." Rubber futures have had a sharp advance upon cables from London intimating that three well-known Americans have succeeded in effecting an agreement between American tire makers and Dutch and English rubber producers, by virtue of which the price will be stabilized and the supply controlled. Details and confirmation of the arrangement are as yet lacking The other commodity markets show no striking changes. Distributive trade is excellent and undoubtedly will set a new high record this fall.

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From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page.

OPTIMISM prevails in the machinery and machine-tool industry throughout most sections of the country, despite the fact that the Cleveland exposition is just beginning to show results in sales. Dealers express themselves as considerably pleased with the exposition from the standpoint of contacts made and general attendance.

DELIVERIES have been improved in some districts and have fallen off in others, deliveries now being as late as April of next year on boring machines. Used tool demand is holding up well. One important price increase, in planers, has been noted.

INDIANAPOLIS reports only a few soft spots and demand holding up well. New York demand has increased, with the electrical field maintaining its interest. Business in general is livening up in Cincinnati. New England sales are indicating a brisk fall, with airplane concerns continuing their activity. Employment has declined in Canada, but demand is good and business is better. Southern District activity is picking up, but Chicago business is showing a slight slump. Detroit outlook is not particularly favorable with the automotive industry curtailing production, but the usual volume of replacement equipment is being ordered. The show seems to have helped Detroit and Chicago but little, but outside that, is responsible for present optimism.

THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine-tool business

THE following reports, gathered from the various machinery and machine-tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

INDIANAPOLIS

Only a few soft spots are noticeable in the machine-tool and machinery trade in this area, mainly in automobile and railroad demands. Railroads, it appears, have cut their repair programs and their new work virtually to the bone. There is one notable exception, however, and that is the Big Four, which is doing quite a bit of work in this state.

The demand from radio manufacturers for special equipment continues unabated. Dealers here say this year will beat last in this field, and there seems no limit to the possibile demand. Demand from the steel industry also is good. Expansions are being made and also quite a few replacements. The aviation field is broadening, and this year thus far has seen a remarkable increase in demand for tools and special equipment from this source. Judging from the interest at this time, the surface in this field has just been scratched.

Farm-implement factories have begun production against the Spring demand and while no large expansions are in sight, there are a lot of sales being made for replacement purposes. Coal-mine machinery is moving a little more rapidly, because of seasonal influences, but the fall business this year is much better than that of last season.

NEW YORK

New York machinery and machine-tool demand has shown a decided increase since the Show in Cleveland. The increase has manifested itself in large numbers of inquiries and also in a number of substantial sales. The new and improved machines on exhibition have drawn a number of the inquiries and a considerable percentage of the orders that have been placed. Demand is not restricted to any industry and the general characteristics of the past few months are still in evidence, but delivery is spotty. In some lines, delivery has improved, but one line of boring machines is now offered for April. One company which has been giving six-week delivery steadily has fallen back to February delivery. Prices are the same, with the exception of a line of planers, which has advanced 10 per cent. Demand is still strong for good used tools.

The electrical field has maintained its interest, and Western Electric has been buying as consistently lately as General Electric. An inquiry list for 10 items was issued last week by General Electric for press department tools, in contrast with recent inquiries for machines for the refrigeration and phototone departments. The New York Central is buying equipment for its Harmon shops.

An indication of the increasing demand is the list of 12 tools sold by the Triplex Machine Tool Co., during the past week. Sales were: one Swiss jig borer, one Mikron gear hobber, one Ames bench miller, one Davis keyseater, one Edlund one-spindle drill press, one No. 3 Oesterlein tool grinder, one Fosdick sensitive drill, one General flexible power press, one LaPorte filer, one Deckel engraver, one Producto gear miller, and one engine lathe.

CINCINNATI

Members of the machine-tool trade of the Cincinnati district take an optimistic view of the immediate future, partly because of the interest shown by those who attended the Cleveland exposition, and partly because of the fact that business, in general, is livening up. Manufacturers state that orders coming in as a result of the exposition, together with those received in the regular course of business, have brought the week's business up to a level which shows a gain over the previous week.

The prevailing opinion is that the demand will increase progressively through the next few weeks, not only for new tools, but also for standard tools in general. "The unusually large attendance at the exhibition and the great amount of interest shown, clearly indicate that the market is about to open up in a fine way," commented a manufacturer. "One thing that should tend to increase activities at once," he explained, "is the fact that nearly all of the new tools shown are in production and can be had quickly, and therefore those who want them will not, as often has been the case, heretofore, have to wait until production begins."

A feature of the week's business was the sale of several lathes to concerns on the Pacific Coast. The general sales of the week were well diversified and well scattered over the country, the principal buyers being small users whose requirements were single tools.

With the number of inquiries acquired at the exposition, and with a good volume coming in through regular channels, sales departments have plenty of fine prospects on which to work. The outstanding inquiry of the week was from the Norfolk & Western Railroad, a list of fifty-two different tools.

NEW ENGLAND

New England machine-tool sales during the current week were at the level that has been in evidence for the past two weeks. In view of the sales of small machines and miscellaneous tools, which were fairly numerous in some centers, slight gains were made over those of the previous week, giving indications of the return of brisk fall buying. Contract shops, small manufacturers, automobile service plants, and machine shops took most of these small units.

With September business conceded generally to have been below that of August, machine-tool builders are anticipating an early return to a higher level of business. Inquiries are encouraging, and, from all indications, October should show improvement. There is no doubt that the Cleveland Show has stimulated interest that will result in sales. The third quarter of the year, in spite of a late September decline, was probably the best third quarter the industry has experienced since the war.

Some houses have made a recent revision of prices. Certain tools, it is noted, are selling at a slightly higher figure, but this is not general. On the other hand a slight revision downward is apparent in rare cases—all of which has resulted in a market stability that should hold indefinitely.

Tool and die manufacturers in this section are active. Several indicate expansion with the purchase of new machinery. One Connecticut textile-machinery manufacturer is building an addition which he will equip with new tools. Developments among New England railroad interests gives promise of buying from a quarter that has been unusually slow this year. Airplane concerns are showing a continuation of the unusual activity that has featured that industry in the New England territory.

CANADA

Present indications are that last-quarter demand for machinery and machine tools in Canada will be exceptionally good. Inquiries have been numerous during the last two weeks, and machine-tool manufacturers in every section of the country are reported to have a good volume of business on hand. While the usual seasonal decline in employment is under way, industrial activity throughout the country still continues at the high level set earlier in the year, and is approximately nine points higher than it was a year ago.

Demand from the electrical supply industries is unusually active. Automobile and radio sales have been stimulated by recent factory exhibitions. Sales of agricultural machinery, particularly in Eastern Canada, are satisfactory, despite the poor grain crop.

Of particular interest is the recent announcement by the Canadian Pacific Railway that during the next five years the company plans new lines in Western Canada, involving the construction of 1,200 miles of track at an expenditure of $50,000,000. Announcement has also been made that the Canadian National Railway is about to proceed with the construction of 10 new switching locomotives. Five will be built at the Point St. Charles shops, Montreal, and five at Transcona, near Winnipeg.

The Westminster Welding Co., New Westminster, B. C., has been busy with several large contracts recently. The company now has two complete portable welding-truck outfits. Business of Canada Foundries and Forgings for the first nine months of the current year is reported to have been greatly in excess of the same period last year.

SOUTHERN DISTRICT

With inquiry improving steadily, and a larger number of orders being booked than in several weeks, optimism over the outlook for business is expressed by most of the leading distributors of machinery and machine tools in this district. A considerably better volume of business is expected during the last quarter of 1929 and the first quarter of 1930.

A few of the larger textile mills are placing orders for equipment for mills that are under way, or for the expansion of facilities in existing mills, and though this trade is better than at this time last season, it is considerably poorer than it was during the spring and summer months of the present year. Building has become active again in the Southeast following the recent protracted spell of rainy weather, and quite a few orders for contractors' machinery and equipment are being booked. This trade is also better than it was at this time last season, and the fall outlook is promising.

Not much buying is being done at this time, however, in the lumber and woodworking field, though the larger furniture factories in the Carolinas, Georgia, and East Tennessee territory are placing a few

orders for such equipment. They are booked well ahead on orders, and are expected to continue fairly good buyers for the next few months. The outlook for road-building machinery is exceptionally good for the first part of 1930, though at present sales are light. Some orders are coming in from larger southeastern railroads for shop equipment, and the outlook also is excellent in this field for the early part of 1930. Small machine shops and garages continue placing a few small orders for used or rebuilt equipment, but are buying little or nothing in the way of new equipment.

CHICAGO

While there is no difference in opinion among those engaged in the machine-tool industry regarding the educative value of the recent Cleveland Exposition, machinery men are hesitant about making forecasts as to just when results in the way of stimulated buying activities may be expected. A few local men who attended the Show told of sales of their products having been consummated during the Exposition, but the general opinion as expressed by the trade is to the effect that the benefits immediately derived were mainly in personal contacts with prospective buyers, and in leads for future business. No change is reported in the condition of the machine-tool market since that noted a week ago. Comparatively little buying is being done, and most of the sales being booked are for single tools and small lots. Decreased production in the automobile industry has somewhat reduced the volume of sales by makers of small tools.

DETROIT

Few orders or inquiries of importance have been received by machinery and machine-tool dealers here during the past two weeks and the general outlook for fall business is not particularly favorable. The automobile industry has diminished its pace considerably and there are no signs of an increase before the first of the year. Some replacement equipment is being purchased and the usual volume of small machinery is being ordered. No broad projects are in sight, however, and few of the manufacturers believe there will be any immediate improvement.

Business Items

The Brewer-Titchener Corporation, Cortland, N. Y., recently awarded a contract for the design and construction of three new units constituting a plant expansion costing about $225,000. The new buildings will be a 60x80-ft. machine shop, a 70x100-ft. structural shop, and a 34x72-ft. storage room. All will be of brick and concrete construction.

The High Point Machine & Manufacturing Co. was organized and incorporated at High Point, N. C., recently with a capital stock of $100,000, and is reported contemplating the operation of a machinery manufacturing plant at that city. The incorporators are O L. Rowland, 1403 Montlien St., High Point, and L. U. Noland, 315 Fifty-fourth St., Newport News, Va.

The Industrial & Combustion Engineering Corporation, 303 Protective Life Bldg., Birmingham, Ala., has been appointed district engineer of the Despatch Oven Co., Minneapolis, Minn., for the state of Ala., Ga., Miss., and Tenn. Ernest Moeller is president, George C. Mapes and Louis Lyon, Jr., vice-presidents.

The Wescott Valve Co., East St. Louis, Ill., has applied for a certificate of incorporation with a capitalization of $1,000,000. The new corporation will take over the assets of the Wescott Valve Co., a Delaware corporation. Officers of the new company are Paul A. Schlafy, president, A. V. Wadsworth, vice-president and general manager, Leo Scharf, secretary and treasurer.

The Federal-Mogul Corporation, Detroit, has recently placed in operation a $300,000 foundry and a 26,400-sq.ft. addition to the factory. The foundry is of brick and steel construction and occupies a ground area of 39,600 sq.ft. The new additions give a total productive area of over 100,000 square feet.

The Pratt & Whitney Aircraft Co., East Hartford, Conn., expects to have its new aircraft-engine plant, 400x1500 ft., in full operation shortly after Jan. 1, 1930. Sufficient land has been set aside to increase the plant fivefold and a 400-acre flying field and airport will be developed when the plant is completed.

The Robert Mitchell Co., Ltd., St. Laurent, Montreal, Canada, expects to have the new plant of the company ready for operation around the beginning of 1930. The new plant will comprise initially the brass and iron foundry departments and will also house extensive research laboratories.

The Merco Nordstrom Valve Co., San Francisco, Calif., has opened a branch office in the Healey Bldg., Atlanta, Ga., for the southeastern states. An office also was opened recently at El Paso, Tex., for the southwestern territory.

The Hamilton Aero Manufacturing Co., is to occupy a western factory, to be completed Nov. 1 at the United Airport, Burbank, Calif., which is being constructed for this unit of the United Aircraft & Transport Corporation under the direction of Boeing Air Transport, according to Boeing officials.

The Arrow Pump Co., Seattle, Wash., has been organized with a capital of $50,000, by J. M. Shields and I. P. McElhany. The company plans to establish a plant at 3131 Western Ave. which is expected to have an initial output of 15 pumps daily.

The Baldwin Locomotive Works, Philadelphia, recently repurchased the Southwark Foundry and Machine Co., and will take over the plant soon. The company will be operated as a separate enterprise under the present management.

The Sprague Specialties Co. will locate in the Beaver Mills' property, North Adams, Mass., early in 1930. The officers are: president and treasurer, Robert C. Sprague; vice-president and manager, Julian E. Sprague; and plant engineer, Frank D. Sprague.

The Ex-Cell-O Aircraft & Tool Corporation, Detroit, is completing a 112 x 440 ft. addition to the Oakman Boulevard plant of the company, to be used exclusively for manufacturing purposes. The addition is a third of a series which cost approximately $275,000. All three are of steel and brick construction with monitor roofs.

The Oneonta Forge & Screw Co., recently incorporated at Oneonta, Ala., with Frank Holcombe as president, and A. A. Fendley as vice-president, will enlarge the facilities of its plant at Oneonta.

The plants of Ryan Aircraft Corporation and Parks Aircraft, Inc., located near St. Louis, are to be consolidated, according to a report by the Detroit Aircraft Corporation.

Personals

H. C. THOMAS, formerly assistant general manager of the merchandising department of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has been appointed director of manufacturing stocks. In his new work he will be responsible for the methods used in the control of all raw materials, work in progress and finished part stocks.

GEORGE ROSE, JR., is in charge of an acetylene gas plant located at 575 Kirkland St., Grand Rapids, Mich., which has just been placed in operation by the Prest-o-Lite Co., Inc., New York City. W. L. POTTS is district superintendent, with headquarters at the Cincinnati Linde Plant. S. P. MURPHY is division superintendent with headquarters at the Bowman Bldg., Pittsburgh.

H. H. CHAMBERS, who joined the Caterpillar Tractor Co. as a laborer at its East Peoria, Ill., plant and has risen to an executive position, has been appointed sales manager for the western division, San Leandro, Calif. I. E. STOUFFER, New York and Pennsylvania district representative, will succeed him in the Peoria office.

V. C. BAKER, formerly in the factory office of the Ampco Twist Drill Co., Jackson, Mich., has been appointed Chicago district sales manager, with offices at 724-28 W. Washington Blvd., Chicago. P. J. MCMULLEN, McMullen Tool & Supply Co., 1702 East Third St., will be manager of the new Dayton branch.

LIEUT. CARL A. DIXON, for the past year operations manager of the L. & H. Aircraft Co., Hartford, Conn., and formerly an officer in the British Royal Flying Corps, has resigned his position with the company to become general sales manager of the Standard Aircraft Corporation, Paterson, N. J.

ROBERT W. WOODRUFF has been elected president of the White Motor Co., Cleveland, and its subsidiaries, succeeding Walter C. White. SAUNDERS JONES has been elected vice-president and assistant to the president; GEORGE

H. KELLY has been made vice-president and treasurer; H. D. CHURCH, vice-president in charge of engineering, and GEORGE W. SMITH, JR., vice-president in charge of production. Mr. Woodruff has been a director of the White company and a member of the executive committee for several years and has been connected with the company for 17 years.

HOWARD BUTT, formerly sales manager of the Air Preheater Corporation, New York, is now affiliated with the Hahn Engineering Co., a division of the Lancaster Iron Works, Inc., Lancaster, Pa. Mr. Butt's headquarters are at the New York office, 101 Park Avenue.

CAREY L. ALLEN, superintendent of the Elizabeth plant of the Durant Co., will remain in Elizabeth until Jan. 1, to wind up Durant affairs at the plant. He is at present supervising the dismantling of the metal-pressing department.

K. T. KELLER, for the past several years vice-president in charge of production of the Chrysler Corporation, and since the acquisition of Dodge Brothers, the general manager of that division, has been appointed vice-president and general manager of all divisions of the Chrysler Corporation.

ARTHUR T. MOREY, general manager of the Commonwealth plant of the General Steel Castings Corporation, Granite City, Ill., has been appointed to the department of manufactures committee of the Chamber of Commerce of the United States.

A. O. SAMUELS is president and treasurer of the Samson-United Corporation which was recently reorganized. H. L. SAMUELS is vice-president and secretary. Other members of the board of directors are: Richard Whitehead, B. B. Goodman, and E. C. Redfern.

B. G. WILLIAMS, formerly associated with the Barnes Drill Co., Rockford, Ill., in the capacity of designer specializing on honing machines, has accepted the position of mechanical designer with Cincinnati Grinders, Inc., Cincinnati.

J. WALTER WHITE, general manager of the W. F. Roberts Steel & Iron Co., Springfield, Ohio, has purchased the bar mill of the Cambridge Steel Co., and the Cambridge Steel Products Co., Cambridge, Ohio. The plant, erected in 1923, is 75x300 ft.

H. W. PETERSON has been appointed manager of the Montreal sales and engineering office of the Stephens-Adamson Manufacturing Co. of Canada. Mr. Peterson has been affiliated with the S-A company for many years.

HARRY W. CROSS has been appointed works manager of the Putman Machine Works, Fitchburg, Mass., to replace W. O. Forman, recently resigned, according to an announcement by Manning, Maxwell & Moore, Inc., New York. Mr. Cross was previously connected with the Westinghouse Electric & Manufacturing Co., Carnegie Steel Co., and Miller Printing Co., and for the last five years was vice-president of the Arch Machinery Co., Pittsburgh representatives of Manning, Maxwell & Moore.

D. G. ANDERSON, chief of the foundry development department of the Hawthorne works, Western Electric Co., Chicago, was recently elected chairman of the board of directors of the Chicago Foundrymen's club.

BERT DINGLEY, vice-president of the Stutz Motor Car Co., Indianapolis, sailed for Europe on Sept. 27, where he will attend the automobile show at Paris, Oct. 3 to 13, and the British Motor Show, London, Oct. 16 to 26.

CHAS. EISLER, president of the Eisler Electric Corporation, sailed on the *Bremen* recently to establish permanent agencies for the company in various European countries.

H. D. HUKILL has resigned from the Westinghouse Air Brake Co., Wilmerding, Pa., to assume management of the recently established power brake division of the Bendix Brake Co., South Bend, Indiana.

W. H. EISENMAN, national secretary of the A.S.S.T., has been appointed a member of the National Research Council Science Advisory Committee to the Chicago World's Fair Century of Progress celebration, to be held in 1933.

JOSEPH F. PFLUM, 3712 Saint Lawrence Ave., Cincinnati, Ohio, has been appointed exclusive representative of the Reed-Prentice Corporation, Worcester, Mass. in the Dayton and Cincinnati districts.

JOSEPH W. ESHELMAN has been appointed representative in the Birmingham, Ala., district for the Pennsylvania Pump & Compressor Co., Easton, Pa. Mr. Eshelman's address is the American Traders Bank Building.

DONALDSON BROWN, vice-president of the General Motors Corporation, has been elected a director of the St. Louis-San Francisco Railroad, succeeding W. S. Franklin, resigned.

ELLIOTT A. ALLEN recently assumed the duties of general sales manager of the Peerless Pump Co., Los Angeles.

J. G. RICHARDS, sales representative of the Stevens-Walden-Worcester Co., Worcester, Mass., has been appointed New England representative.

RUDOLPH NELSON has been added to the staff of the Chicago Branch of the United States Electrical Tool Co., Cincinnati, Ohio.

FRANK DISSTON of Henry Disston & Sons, Inc., Philadelphia, returned recently from an extended trip to Europe.

G. H. HEDRICK, vice-president of the Thomas Spacing Machine Co., Pittsburgh, has resigned.

HIBBARD S. GREENE, former vice-president and director of the Barber-Greene Co., Aurora, Ill., has been appointed assistant to the president of the Chain Belt Co., Milwaukee, Wis. His headquarters will be at the Milwaukee plant of the Chain Belt company.

Obituaries

JOHN HENDRY, 73, master car builder of the Canadian National Railway, died at his home in Westmount, Que., on Sept. 26. Mr. Hendry was a native of Scotland. He went to Montreal in 1906, when he became connected with the Canadian Car and Foundry Co. Some time later he became connected with the Grand Trunk Railway and retained his position when that railway merged with the Canadian National.

G. T. SHANTS, 63, Philadelphia district manager of the Lukens Steel Co., Coatesville, Pa., and president of the Pittstown Foundry & Machine Co., Pittstown, Pa., died on Oct. 3 at his home in Germantown, Pennsylvania.

HORACE WILLOUGHBY, 58, president of the Crane Co., died recently following an illness of 2 years. He was also secretary of the National Pipe and Supply Company.

CARL H. GRAF, treasurer of the Albany Foundry Co., Albany, N. Y., died on Oct. 4 in Albany. He was 60 years of age.

GEORGE W. GILBERT, 58, vice-president of A. Gilbert & Sons Brass Foundry Co., St. Louis, Mo., died recently.

J. M. GARDNER, 46, president of the Gardner Tap & Die Co., Marion, Ohio, died in Marion on Sept. 13.

Forthcoming Meetings

GRAY IRON INSTITUTE—Annual meeting, Hotel Cleveland, Cleveland, Ohio, Wednesday, Oct. 16. Information may be obtained from Arthur J. Tuscany, manager, Terminal Tower Building, Cleveland.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Regional meeting, Akron, Ohio, Oct. 21 to 23. Calvin W. Rice, 29 W. 39th St., is secretary.

SOCIETY OF INDUSTRIAL ENGINEERS. Sixteenth national convention at Hotel Statler, Cleveland, October 23 to 25. Requests for programs should be sent to S.I.E. national office, 205 West Wacker Drive, Chicago.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION. Semi-annual fall meeting at the Benjamin Franklin Hotel, Philadelphia, October 24 to 26. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS — Annual meeting, New York, Dec. 2 to 6. Headquarters will be at 29 W. 39th St., New York City. Calvin W. Rice is secretary.

THE WEEKLY PRICE GUIDE . . .

Rise and Fall of the Market

THE railroads and the automotive industry occupy opposite ends of the current steel market, with the former buying most of the steel now moving and the latter taking the least. Structurals, ship building and agricultural implement material comprise the remainder of the present volume of orders. No further softening of prices is foreseen, shapes and soft steel bars bringing $1.90 per 100 lb., Pittsburgh, in large mill lots and plates, $1.95. With the exception of a rise of ½c. per lb (10¾@11½c.) in zinc sheets at New York warehouses, other non-ferrous metals tend downward. Genuine, highest grade babbitt is off 4c. per lb. (60c.) at New York warehouses. Declines occurred also in tin, solder, scrap copper, brass and lead.

(All prices as of Oct. 11, 1929)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$17.69@$18.19
Northern Basic	19.90
Southern Ohio No. 2	19.90
NEW YORK—Tidewater Delivery	
No. 2 Southern (silicon 1.75@2.25)	19.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	14.00@14.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.26@21.76
Virginia No. 2	24.04
Basic	19.75@20.25
CHICAGO	
No. 2 Foundry, local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	20.01
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	20.26
Basic	20.26
Bessemer	20.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.50
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed*	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.20	3.35	3.30	3.90†
No. 12	2.15@2.25	3.45	3.35	3.95†
No. 14	2.25@2.35	3.55	3.45	4.00†
No. 16	2.35@2.45	3.65	3.55	4.10†
Black				
Nos. 18 to 20	2.65	3.85	3.70	3.80
No. 22	2.80	4.00	3.85	3.95
No. 24	2.85	4.05	3.90	4.00
No. 26	2.95	4.15	4.00	4.10
No. 28	3.10	4.75	4.15	4.25
Galvanized				
No. 10	2.80@2.90	4.20	4.05	4.05
Nos. 12 to 14	2.90@3.00	4.30	4.15	4.15
No. 16	3.00@3.10	4.40	4.25	4.25
No. 18	3.15@3.25	4.55	4.40	4.40
No. 20	3.30@3.40	4.70	4.60	4.55
No. 22	3.35@3.45	4.75	4.65	4.60
No. 24	3.50@3.60	4.90	4.75	4.75
No. 26	3.75@3.85	5.15	5.00	5.00
No. 28	4.00@4.10	5.40	5.25	5.25

*Light plates. †Up to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. butt	53.74%	41.2%	55.5%	43.5%	55.5%	42.5%
3½ to 6 in. lap	50.32%	37.78%	53.5%	40.5%	51.6%	39.0%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches External	Diameter in Inches Internal	Thickness Inches
⅛	$0.17	1.315	1.049	.133
¼	.23	1.66	1.38	.14
⅜	.27½	1.9	1.61	.145
½	.37	2.375	2.067	.154
⅝	.58½	2.875	2.469	.203
¾	.76½	3.5	3.068	.216
⅞	.92	4.0	3.548	.226
1	1.09	4.5	4.026	.237
1¼	1.48	5.563	5.047	.258
1½	1.92	6.625	6.065	.28
2	2.50	8.625	8.071	.277

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

Thickness B.w.g. and Decimal Fractions		Outside Diameter in Inches ⅛	¼	⅜	½	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.25†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00
Cold drawn, round or hexagon‡	3.60	3.65	3.60
Cold drawn, flat or square‡	4.10	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.25†	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	3.75†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.25	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, 3/16-in. thick. †Up to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire at New York warehouse— 3/32, 8.35c. per lb.; ⅛, 7.85c. per lb.; 5/32 to ½, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			19.25
Tin, Straits, pigs, New York			47.00@48.00
Lead, pigs, E. St. Louis	6.70	New York	7.62½@8.12½
Zinc, slabs, E. St. Louis	6.80	New York	7.75@8.25

	New York	Cleveland	Chicago
Antimony, slabs	11.00@11.50	11.75	14.50
Copper sheets, base	27.75	27.75	27.75
Copper wire, mill, base	20.12½	20.12½	20.12½
Copper, drawn, round, base	26.25	26.25	26.25
Copper tubing, base	29.25	29.25	29.25
Brass sheets, high, base	23.25	23.25	23.25
Brass tubing, high, base	28.25	28.25	28.25
Brass rods, high, base	21.25	21.25	21.25
Brass wire, high, base	23.75	23.75	23.75

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25@26	24.30	24.30
Zinc sheets (casks).....	10.75@11.25	11.70	10.11
Solder (½ and ½).....	32.00	32.75	31@34
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade.....			60.00
Commercial genuine, intermediate grade.....			43.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt.....			12.00

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished.....	52.00	42.00
Sheets, cold rolled.....	60.00	50.00
Strip, cold rolled.....	55.00	45.00
Rods, hot rolled.....	45.00	35.00
Rods, cold drawn.....	53.00	40.00
Tubing	75.00*	90.00†
Angles, hot rolled.....	50.00	40.00
Plates.....	52.00	42.00

*Beamless. †Welded.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity offered for sale:

	New York	Cleveland	Chicago
Crucible copper.....	15.50 @15.75	13.50	13.00 @14.00
Copper, heavy, and wire..	14.75 @15.75	13.00	12.00 @13.00
Copper, light, and bottoms	12.75 @13.50	12.50	11.00 @12.00
Heavy lead.....	5.50 @ 5.75	6.25	4.75 @ 5.25
Tea lead.....	4.00 @ 4.25	4.25	3.75 @ 4.25
Brass, heavy, yellow.....	8.25 @ 8.75	8.00	8.00 @ 8.50
Brass, heavy, red.....	12.00 @12.50	12.50	11.75 @12.25
Brass, light.....	7.00 @ 7.50	7.50	7.00 @ 7.50
No. 1 yellow rod turnings.	9.75 @10.25	9.00	9.00 @ 9.50
Zinc.....	3.25 @ 3.50	3.25	3.00 @ 3.25

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20.....	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20.....	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20.....	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb..	$0.13*	$0.16	$0.15
Cotton waste, colored, per lb..	.09½*	.12	.12
Wiping cloths, washed, white, per lb.....	.12½	38.00 per M	.16
Sal soda, per lb.....	.02½	.02	.02
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.171	.174	.167
Cutting oil, about 25% lard, in 5 gal. cans, per gal.....	.75	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal..	.33	.36	.24
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt...	30%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60– 5%	50–10%

*Grade F.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb..	$0.0325	$0.033	$0.0325
Cold drawn shafting...	per lb..	.036	.036	.034
Brass rods.....	per lb..	.2125	.2125	.175
Solder (½ and ½).....	per lb..	.32	.3325	.3475
Cotton waste, white...	per lb..	.13	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia.....	per 100.	3.60	3.60	3.05
Lard cutting oil.....	per gal.	.75	.75	.65
Machine oil.....	per gal.	.33	.33	.30
Belting, leather, medium.....	off list..	30–10%	30–10%	30–10%
Machine bolts, up to 1x30 in., full kegs...	off list..	50-10%*	50–10%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper.....	$4.86	$4.29	$4.29
Emery cloth.....	22.93	20.97	20.97
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper.....	2.08	2.04	2.04
Cloth.....	3.60	3.59	3.59
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton.....	Connellsville, 2.65@2.75		
Coke, prompt foundry, per net ton.....	Connellsville, 3.75@4.85		
White lead, dry or in oil...	100 lb. kegs....	New York, 13.75	
Red lead, dry.....	100 lb. kegs....	New York, 13.75	
Red lead, in oil.....	100 lb. kegs....	New York, 15.25	

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less.....	60%
Larger, up to 1 x 30-in., full kegs, list less.....	50–10%
Less than full kegs or case lots, add to list.....	10%
Fitting-up bolts: list less.....	45%
Lag screws:	
Up to ½-in. x 6-in., list less.....	60%
Larger, list less.....	50–10%
Less than full keg or case lots, add to list.....	10%
Rivets:	
Structural, round head, full kegs, net.....	$4.50
Structural, round head, broken kegs, net.....	6.00
Tank, 7/16-in. dia. and smaller, list less.....	60%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less.....	60%
Larger, up to 3-in., list less.....	40–10%
Less than keg or case lots, add to list.....	10%
Washers:	
Wrought, full kegs, per 100 lb., list less.....	$4.00
Wrought, broken kegs, per 100 lb., list less.....	2.00
Turnbuckles:	
With stub ends, list less.....	20%
Without stub ends, list less.....	50%
Chain:	
Proof coil, base, per 100 lb., net.....	$7.10
Cast iron welding flux, per lb., net.....	.40
Brazing flux, per lb., net.....	.80

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

D. C., Washington—A. L. Flint, General Purchasing Officer of the Panama Canal—will receive bids until Oct. 25 for pneumatic hammers, etc.

Mich., Flint—A. C. Spark Plug Co., Harriet St.—additional equipment for ceramic department for proposed 3 story, 100 x 160 ft. spark plug factory. Estimated cost $125,000.

Mich., Port Huron—United Brass & Aluminum Co., 3127 Goulden Ave.—light foundry and machine shop equipment for proposed 1 story, 60 x 200 ft. factory. Estimated cost $45,000.

Mich., River Rouge—Keystone Engineering Co., 100 East Cicotle St.—No. 3 Armstrong pipe threading machine.

N. Y., Brooklyn—Signal Supply Officer, Signal Section, New York, General Depot, 58th St. and First Ave.—will receive bids until Oct. 29 for forty-four machine screw taps and thirty-two screw cutting dies, various sizes.

O., Cleveland—R. C. Huffman Construction Co., Terminal Tower—gas driven portable electric welding outfit.

Ore., Klamath Falls—Balsieger Motor Co.—lathes and automobile tools, electric drive for proposed garage and shops. Estimated cost $87,174.

Ont., Kingston — Bd. of Education, A. J. Meiklejohn, Chn. — machinery and equipment, including lathes, tools, woodworking equipment, etc., for proposed 3 story technical school on Earl St. Estimated cost $350,000.

Ont., Waterloo — Waterloo Mfg. Co., A. T. Thom, Gen. Mgr.—complete new equipment for the manufacture of combines (auto header type) for proposed addition to plant on Union St. Estimated cost $250,000.

Opportunities for Future Business

Ala., Birmingham — Continental Gin Co., Fourth Ave. and 46th St., manufacturers of cotton gin machinery, plans the construction of additional unit to plant and warehouse. Estimated cost $100,000.

Calif., Burbank—Hamilton Aero Mfg. Co., c/o Austin Co. of California, 777 East Washington St., Los Angeles, Archt., is having plans prepared for a 1 story factory.

Calif., Los Angeles — Aluminum Industries, Inc., 2438 Beekman St., Cincinnati, O., plans the construction of a factory and warehouse. Estimated cost to exceed $40,000.

Calif., Los Angeles—Curtiss Flying Service of California, is having plans prepared for the construction of a group of airport buildings, including hangars, administration buildings, etc., at Mines Field. Estimated cost $2,000,000. Gable & Wyant, 3723 Wilshire Blvd., Archts.

Calif., Los Angeles—Willard Storage Battery Co., East 131st St. and St. Clair Ave., Cleveland, O. is receiving bids for a 1 story, 150 x 300 ft. factory at East 9th and Gerhart Sts. Estimated cost $500,000. A. Beelman, 1019 Union Bank Bldg., Archt.

Conn., Bridgeport — Cochrane Chevrolet Co., 1710 Main St., is having plans prepared for a 3 story, 60 x 100 ft. sales and service station. Estimated cost $80,000. Fletcher Thompson, Inc., 542 Fairfield Ave., Archt.

Conn., Milford—Continental Airports, Inc., is having plans prepared for the construction of an airport, including hangars, shops, etc. Estimated cost $100,000. L. F. Caproni, 1056 Chapel, New Haven, Engr.

Del., Wilmington—E. I. Dupont de Nemours Co., Du Pont Bldg., awarded contract for the construction of a 1 story machine shop at Maryland Ave. and Beech Sts. Estimated cost $38,000.

Ill., Chicago—Binks Spray Equipment Co., 3124 Carroll Ave., is having plans prepared for a 2 and 3 story, 150 x 325 and 75 x 150 ft. factory, for the manufacture of spraying machines to whitewash and spray fruit trees, etc. Estimated cost $500,000. C. Hauber, 25 East Jackson Blvd., Archt.

Ill., Maywood — J. C. Llewellyn & Co., 38 South Dearborn St., Archts., will receive bids until Nov. 7 for a 2 and 3 story addition to high school, including machine shop, manual training shop, etc., on First Ave. for Proviso Township High School Dist. No. 209. Estimated cost $800,000.

Ind., Indianapolis—American Metal Furniture Co., 325 West 17th St., awarded contract for the construction of a 150 x 200 ft. factory. Estimated cost $100,000.

Ind., Indianapolis — Westinghouse Electric Co., 814 North Senate St., is having plans prepared for the construction of an 80 x 90 ft. service building at 551 West Maryland St. Estimated cost $65,000. C. Byfield, 923 Peoples Bank Bldg., Archt.

Ind., South Bend — Bendix Aviation Co., awarded contract for the construction of a 360 x 1,000 ft. factory. Estimated cost $400,000.

Ky., Louisville — Ditto-Johnson Motor Co., Brook and Broadway, plans the construction of a 2 story garage at Bardstown Rd. and Grinsted Dr. Estimated cost $150,000.

Ky., Louisville—Reynolds Metal Co., 30th and Grand Ave., will build six 1 story factory buildings for the manufacture of aluminum powder at Camp Ground Rd. Estimated cost $120,000. A. G. Tafel, 140 South Third St., Archt.

Mass., Abington (sta. North Abington)—Anglo American Textile Machinery Co., had plans prepared for two additional units, 1 story, 35 x 110 ft. each. Estimated cost $40,000. Private plans. Noted Oct. 3.

Mass., Everett (Boston P.O.)—Warren Foundry & Pipe Co., 201 Devonshire St., Boston, is receiving bids for the construction of a 1 and 2 story pipe foundry and warehouse here. French & Hubbard, 210 South St., Boston, Engrs. Noted Aug. 29.

Mass., Malden—W. E. Arnold Co., 17 Centre St., awarded contract for a 1 story, 60 x 100 ft. machine shop at 81 Abbott St. Estimated cost $40,000.

Mass., Needham (Boston P.O.)—Town, E. L. Morse, Chn. Bldg. Committee, awarded contract for the construction of a 3 story, 100 x 200 ft. school including manual training, domestic and science shops, on Richwagon Hill. Estimated cost $420,000. Noted July 11.

Mass., New Bedford—Allen Co., 136 River Rd., will build a woodworking shop. Private plans.

Mass., Somerville (Boston P.O.)—J. J. Durant, 84 Washington St., plans addition and alterations to repair and service garage. Private plans.

Mass., South Boston (Boston P. O.)—C. I. Brink, 24 Gold St., manufacturers signs, awarded contract for a 2 story, 65 x 80 ft. factory. Estimated cost $40,000.

Mass., Waltham—M. Sullivan, 1024 Main St., is having plans prepared for a 1 story repair and service garage at 1025 Main St. Estimated cost $40,000. W. Haines & Son, 32 Riverview Ave., Archts.

Mich., Detroit—American Twist Drill & Tool Co., 2804 West Jefferson Ave., plans the construction of a 1 story, 180 x 200 ft., factory. Estimated cost $100,000. C. W. Ditchy, 415 Brainard St., Archt.

Mich., Detroit—Commerce Pattern Foundry & Machine Co., awarded contract for the design and construction of a new unit to plant for the manufacture of machine tools on Grand River Ave. Estimated cost $30,000.

Mich., Lansing—Fisher Body Corp., General Motors Bldg., Detroit, awarded contract for a 1 and 2 story, 140 x 250 and 70 x 150 ft. body factory on Division St. here. Estimated cost $250,000.

Minn., Minneapolis — Minneapolis Gas Light Co., J. K. Swanson, V. Pres. and Gen. Mgr., 16 South 7th St., plans the construction of repair shops, garage, service station, etc., at Lyndale and Linden Aves. Estimated cost $250,000.

Mo., Jefferson City—Jefferson City Duck Decoy Co., H. Benz, Gen. Mgr., will build a 2 story, 40 x 100 ft. factory at Highway No. 50 and Waverly St.

Mo., St. Louis—Carter Carburetor Co., 2838 North Spring Ave., awarded contract for a 1 story, 50 x 222 and 42 x 45 ft. addition to factory. Estimated cost $40,000.

N. J., Newark—Newark Rivet Works, 262 Lafayette Ave., awarded contract for a 4 story, 100 x 100 ft. rivet plant. Estimated cost $50,000.

N. J., North Bergen—Township Commission, Municipal Bldg., will receive bids about Oct. 22 for the construction of a 3 story, 90 x 110 ft. garage. Estimated cost $150,000. R. B. Glenn, Municipal Bldg., Archt. and Engr.

N. J., Trenton—Nucar Forwarding Co., Prospect St., W. Bradford Stryker, 321 West State St., will build an 80 x 200 ft. factory for the manufacture of trucks and trailers. Estimated cost $50,000.

N. Y., Buffalo—Stewart Motor Co., 93 Dewey Ave., awarded contract for a 25 x 97 ft. factory. Estimated cost $60,000. Noted Sept. 19.

N. Y., Forest Hills—Seal Lock Burial Vault Inc., awarded contract for the construction of a factory at 68th Rd. and Woodhaven Blvd. Estimated cost $40,000. Noted Sept. 26.

N. Y., New York — G. Halpern, 540 East Fordham Rd., plans the construction of a 2 story, 100 x 100 ft. garage at 172 St. Jerome Ave. Estimated cost $40,000. W. F. Doyle, 11 John St., Archt.

N. Y., New York — Seventy East 11th St. Corp., H. Kay, Pres., 70 East 11th St., is receiving bids for the construction of a 6 story garage. Estimated cost $50,000. W. Shary, 22 East 17th St., Archt. Noted Oct. 3.

N. Y., New York—Waltmore Realty Corp., S. Elliott, Pres., 68 East 116th St., plans the construction of a garage at 265 Sherman Ave. Estimated cost $120,000. M. W. Del Gaudio, 545 5th Ave., Archt.

N. J., West New York—De Luxe Auto Bodies Inc., P. Wishidensky, Pres., 5124 Hudson Blvd., is having plans prepared for the construction of a 1 story, 115 x 135 x 151 ft. auto body manufacturing plant at Hudson Blvd. and 21st St. Estimated cost $40,000. Architect not announced. Noted Sept. 26.

N. Y., Cortland — Brewer-Titchener Corp., 16112 Euclid St., manufacturers of automotive parts, awarded contract for the design and construction of a 60 x 80 ft. machine shop, 70 x 100 ft. forge shop and 34 x 72 ft. storage shed. Estimated cost $225,000.

N. C., High Point—Industrial Electric & Machine Co., 507 East Russell St., plans the construction of a new foundry to operate in conjunction with other department of plant.

O., Cleveland—Columbia Metal Stamping & Die Co., A. E. Koch, Secy. and Treas., 1536 East 49th St., awarded contract for a 1 story, 90 x 220 ft. factory on East 116th St. and Harvard Ave. Estimated cost $150,000.

O., Cleveland—The Dill Mfg. Co., G. D. Williamson, Pres., 694 East 82nd St., plans the construction of a factory for the manufacture of metal stampings on Mandalay Rd. Estimated cost $100,000. Roberts-Wright Co., Swetland Bldg., Archt. Noted Sept. 5.

O., Cleveland—Osborn Mfg. Co. and E. W. Hopp, Supt., 5401 Hamilton Ave., manufacturers of brushes and foundry equipment, awarded contract for the construction of a 4 story, 49 x 106 ft. factory. Estimated cost $100,000. Noted Oct. 3.

O., Cleveland — E. T. Pierce Co., 4903 Harlem Ave., die manufacturers, had plans prepared for the construction of a 1 story, 60 x 100 ft. factory on East 49th St. Estimated cost $50,000. G. A. Ebeling, 737 Prospect Ave., Archt.

O., Cleveland—Screw & Fastener Supply Co., 3913 Mayfield Rd., awarded contract for a 1 story factory on Inman Ave. Estimated cost $40,000.

Pa., East Pittsburgh—Westinghouse Electric & Mfg. Co., awarded contract for the construction of a service building, power plant and research building on Ardmore Blvd. Noted Oct. 3.

Pa., Lebanon—Wilbur Watson & Associates, 4614 Prospect Ave., Cleveland, O., Archts., are receiving bids for the construction of a 2 story, 150 x 182 ft. foundry for Lebanon Steel Foundry Co., Lebanon.

Pa., McKeesport—National Tube Co., subsidiary of U. S. Steel Co., 71 Broadway, New York, N. Y., G. G. Goe, Frick Bldg., Pittsburgh, local Purch. Agt., awarded contract for two seamless tube mills, one open hearth mill and one bar mill. Estimated cost $20,000,000.

Pa., Oil City—W. W. Jeffry Co., Seneca St., awarded contract for a 1 story, 117 x 132 ft. garage on Seneca St. Estimated cost $50,000.

R. I., Providence—Milowitz & Collins, 109 Pearl St., is receiving bids for a 1 story, 100 x 160 ft. garage on North Main St. Estimated cost $65,000. H. Marshak, 36 Exchange Pl., Archt.

Tenn., Franklin—Allen Mfg. Co., 300 10th Ave., Nashville, manufacturers of stoves, acquired a site and plans the construction of a foundry and machine shop here. Estimated cost $200,000.

Tex., Houston—Hughes Tool Co., 300 Hughes St., awarded contract for a new structural steel shop in connection with main unit of plant.

Utah, Salt Lake City—Tri-State Motor Co., M. R. Richards, Mgr., plans the construction of a garage. Estimated cost $85,000.

Wis., Milwaukee—Pyramid Holding Co., c/o B. Uthus, Archt., awarded contract for a 5 story, 60 x 145 ft. garage on 23rd St.

B. C., Burnaby—Dominion Bridge Co., 275 First Ave. W., Vancouver, awarded contract for the construction of a 210 x 600 ft. structural steel fabricating plant including power house, etc. on Burnaby Rd. Estimated cost $1,000,000. A. S. Gentles, 275 First Ave. W., Engr.